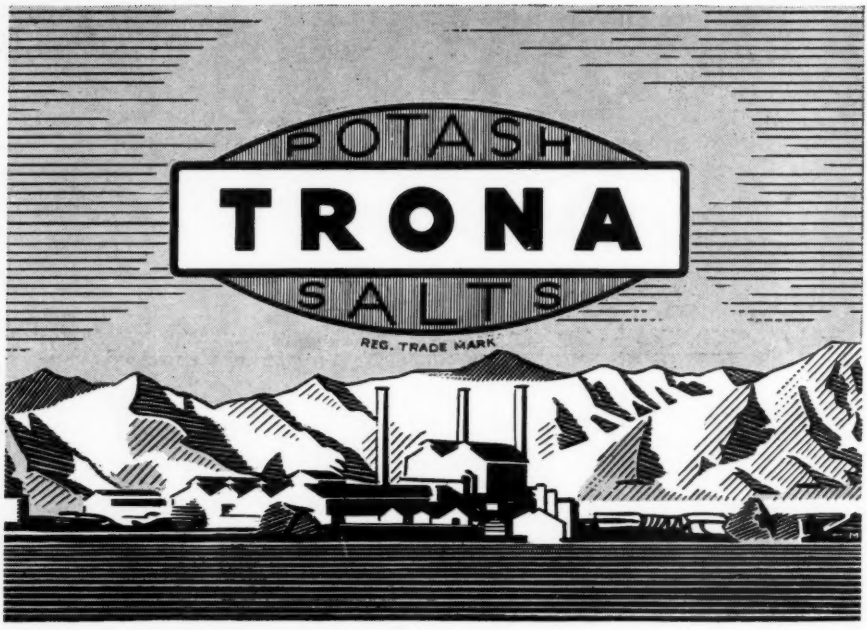
Better Crops WITH PLANT FOOD

July-Aug. 1935 10 Cents

The Pocket Book of Agriculture



TRONA MURIATE of POTASH

Muriate of Potash 80/85% KCl

Muriate of Potash 95/98% KCl

American Potash & Chemical Corporation

70 Pine Street New York

Sales Offices:

Atlanta, Ga. Baltimore, Md. Columbus, Ohio

PIONEER PRODUCERS OF MURIATE IN AMERICA

Better Crops with PLANT FOOD

The Whole Truth — Not Selected Truth

R. H. STINCHFIELD, *Editor*

Editorial Offices: Investment Bldg., Washington, D. C.

VOLUME XX NUMBER TWO

TABLE OF CONTENTS, JULY-AUG. 1935

Science Plus . . . . . *By Jeff McDermid* 3

Connecticut Valley Soils Need Potash *By Ford S. Prince* 7

The Inquiring Mind and the Seeing Eye *By Dr. A. S. Alexander* 10

Micro-chemical Methods as an Aid in Studying Soil Fertility Problems *By Jackson B. Hester* 13

Muck-Grown Potatoes Can Top the Market *By E. B. Tussing* 18

The Humus Front . . . *By Dr. R. E. Stephenson* 21

Black Locusts Will Anchor Sand *By A. F. Gustafson* 22

Editorials 27

Reviews 29

Erosion on Small Slopes 31

Michigan Grows Good Potatoes . . *By J. J. Bird* 32

Disease-resistant Varieties of Crops *By Dr. E. N. Bressman* 35

Reed Canary Grass Demands Plant Food *By H. L. Harris* 37

Crop of Timothy Seed Seems Certain Profit . . 39

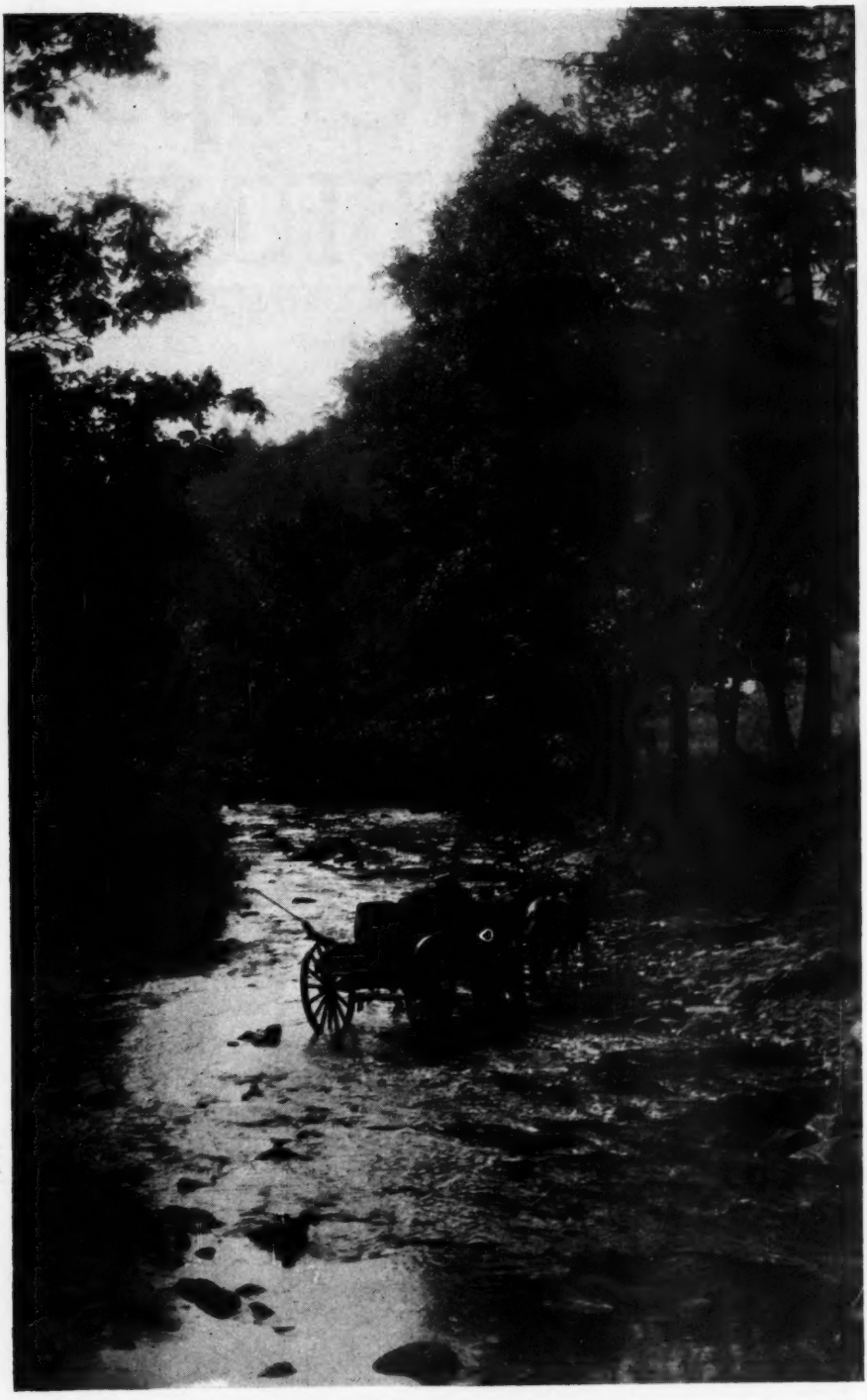
Sod Dams Save Soil . . . . . *By A. A. Jeffrey* 43

American Potash Institute, Inc.

Investment Building, Washington, D. C.

J. W. TURRENTINE, *President and Treasurer*

G. J. CALLISTER, *Vice-President and Secretary*



REMINISCENT OF THE OLD THRESHING OUTFITS

Better Crops with PLANT FOOD

PUBLISHED BI-MONTHLY BY THE BETTER CROPS PUBLISHING CORPORATION INCORPORATED UNDER THE LAWS OF THE STATE OF NEW YORK, WITH OFFICES IN THE INVESTMENT BUILDING, WASHINGTON, D. C. SUBSCRIPTION, $1.00 FOR 12 ISSUES; 10c PER COPY. COPYRIGHT, 1935, BY THE BETTER CROPS PUBLISHING CORPORATION, NEW YORK.

VOL. XX WASHINGTON, D. C., JULY-AUG. 1935 No. 2

Jeff says, "It's in the cards, no matter who deals them."

Science Plus

By Jeff McDermid

ORIGINALLY devised to utilize laboratory science in the conquest of the boll-weevil and the poll-evil, the farm extension service has of late helped to establish a rural economic democracy fitted for an emergency, out of the charts, curves, and indices of economic science, reinforced by processing taxes and benefit payments. Thus emerged the era of the test tube plus the slide rule plus organized and "subsidized" determination.

Let's start with Genesis and drift along toward the apocalypse. One best gets a glimpse of the future by scanning the past. County agents and extension specialists, as I first knew them nearly a score of years ago, were field educators. At first their movements were regarded with skepticism or tolerance, or even bitterness, surrounded as they were by men of the old practical school who had little fondness for or dependence upon books or pencils in farming.

Gradually as the more scholarly sons took charge of the farms and communities, the lot of the county agents assumed a brighter hue, while some distinct gains were made in the application of science to farm and livestock problems, over the plaintive

wails of the stand-patters.

The gang at the court-house used to snicker when the county agent came in loaded down with soil samples, bunches of weeds to identify, and other stray mementoes of his rattling peregrinations.

THE pompous county clerk and the dry little county treasurer would proceed to the sheriff's dingy sanctum and exchange bits of jealous comment on this interloper who "rode around on county gas at more than twice our wages." Or they would go down to the drug store and swap stabs at the county agent with the tight-lipped old apothecary, mixer of questionable livestock dips and dopes, who railed savagely because the newcomer had been telling the farmers to substitute good feeding, testing, and sanitation in place of sure-fire cure-alls. If they still had a grudge unsatisfied, these moochers would spend the evening with the dour, old, cross-grained and entirely rugged and ruthless stock-buyer, in his shack near the chutes at the depot. That worthy would show them his books to prove how damaging to local trade and private profits were the pools and pro rata sheets of the cooperative livestock sales unit, which this new scapegoat from the university had introduced to the countryside.

Then, one by one, these foeman of the extension man and stoppers of education would inveigle the unwary and whisper advice to them to disband the farm bureau or elect good old-time pioneers to the county board once more.

IT wasn't usually the "big selfish corporations" who tried to undermine the local business of awakening the farmer and helping him to act as an intelligent unit in a well-informed group. On the contrary, some real aid came to hard-pressed county agents and farm leaders from the broader-gauged companies allied with agricultural commerce.

It is significant to recall that it was the rural-minded folks of Dixie who began the first county agent work in 1904 and 1906, when Evans, Procter, and Bill Stallings went into Texas to carry on the initial itinerant teaching by demonstration. Not until 1910, when Pennsylvania and Ohio inaugurated the first northern county agent work did it expand to the region which has since become its chief field of effort.

"Personal contact" was the motivating theory of the famous Smith-Lever Act of 1914, ushering in the $1,200 salary, the horse and buggy, and the weekly circuit-riding of those 928 county agents who used their homes for offices, wrote their reports on Sundays in longhand, and paid their own expenses. Some of them returned home at the week-end with all the plunder of an impecunious Methodist minister or a country editor, provided by the generosity of their remote constituents.

THEY were told by the preamble of their charter to "aid in diffusing among the people of the United States useful and practical information on subjects relating to agriculture and home economics and to encourage the application of the same." No mention yet of any economic emergency or restoration of agricultural purchasing power. State contributory financial aid was the keynote of its provisions, and hence it became one of those early misnomers, "legislative bribery," over which the critics and cautious Charlies spent so much useless blather. Some of the skin-penny boys had it all figured out to a nickel an acre as to the terrible burden which such new-fangled notions posited on the patient public.

After a decade of this side-road evangelism with many backsliders, an accidental outgrowth of extension

work proved its salvation at a time when things were becoming pretty stale. Somebody discovered that farm kids would not hanker for city excitement if their leaders made farm life a pleasure and a challenge and farm work a brisk and thrilling game of wits and alertness. It was a darn sight nicer to herd with a bunch of awkward young lads and rosy-cheeked damsels than to be an adult reformer.

National development of the youth movement started in earnest with the eighty per cent salary provision of the

Capper-Ketcham Act of 1928, devoting that portion solely to captains of junior bush-leaguers in the work which put zest into the extension field and revitalized many discouraged rural communities. Yet tougher times were coming and men of steel resolve were needed to withstand their rigors and rise above their defeats.

It is a godsend that the 4-H movement got its roots established before the heavy clouds of the post-war period blotted out the sun of agriculture. Had it not been for the enlistment and training received by many present-day farmers in the 4-H army, no effective alignment for the years of 1932 to 1935 would have been possible. And even beyond, in the trying and critical times through which agriculture must pass before its legal status to self-determination and broad national planning is fixed, we shall truly find that the seeds of the "head, heart and hands," pledged to carry on, will bear enormous yields.

Turning next to the Farm Board period of dilemma and vain voluntary appeals for crop adjustment that ensued after Government stabilization alone had failed, we see the extension folks doing their best to follow the flag. While Professor Spillman and others were conjuring up a way out through the domestic allotment plan, the cow-testers and soil-mappers kept plugging along on the individualistic path because no other large movement with sufficient national force and recognition had been hatched.

Of course there were a crop of strikes and plenty of moratoriums to choose from, but somehow these lacked common sense and seemed like going after wolves with air-guns. Few of the county agents got much "het up" over the noise-makers of the lunatic-fringe rebellion. Like wise soldiers they kept their strength in reserve and their automatics well oiled for big game. Just one thing may be said for the rabble rousers, which is that in a way they helped to shift the scenery around and get the stage all set for the grand entrance of the coup d'e tat. Otherwise, without the blue blazes and the red fire, the famous young AAA would have died aborning in Congress and become a snoring "ZZZ."

FEW folks know it, but along in the primitive days of the much-berated and much-blessed agency referred to there was a slight hitch about using the county agent system for the prime mover of the business. Some doubters feared it would interfere with the scientific side of their work and still others raised the old bogey of prejudice.

But the machine was all there, fairly well geared up, and it would have been time-wasting and expensive to attempt an entirely new organization

afield. Many of the boys were part-time Federal agents anyhow, so in the end the resistance broke down and the extension system assumed its proper function in a way it had long sought to do.

Much of an illuminating nature could be fixed up in readable form concerning the job the boys had coaching some of their State leaders so as to shove the Generals ahead in double formation in periods when snipers began taking pot-shots at the new "farm trust." I reckon they often had more fuss and bother with their own majordomos than they had with the pigless sows, the sowless pigs, and the cornless quarter sections. This, however, is only an incident in the tale of an epoch, so let's forget it.

THOUGHTFUL surveys of the extension service in these recent years of farm credit and crop adjustment, drought hazards, and super-organization in a crisis, convince anyone that the machine ran smoothly. In a few days more than 70,000 production-control committeemen were hitched into the harness and ready to drive ahead in the greatest single piece of social engineering that American farming has witnessed. County agents did it.

There were enough delay, legal fog, and contrary orders to put the average untrained fellow into the filbert class in short order; but somehow, trained as they were in patience and endurance, the majority of the agents hung on like grim death and saw it through. They had to. Unless they carried on, the whole caboodle of contracts would have gone amiss, the radical rooters would have taken the reservation, and the extension system itself might have vanished.

There were probably few of those five million contracts which some of the boys did not have a hand in signing. Similarly and simultaneously, while the adjustment furore was on full tilt, the mortgage amortizing business, starvation livestock, live-at-home-if-you-can, and bitter dust storms contributed to keep the county agent from ennui. Give all the credit you wish to Washington, D. C., but save a shred or two for the home brigade. And when, in the aftermath, any cussing is in order, the boys can take it, too, and send a little of it back if necessary.

And don't forget the duties they had to foster on the side, just as usual, for the folks who signed no contracts and couldn't be hired to do it by anybody on earth. *They* demanded help to produce more instead of less, and I suspect we owe some of our ever-normal granary to the back-action along that line by the county agents serving the die-hards. And again, there was the problem of replacement crops, soil-salvage, legumes, erosion, better pastures, dairymen versus the rest of the universe, and the enraged tax-paying consumer who thought it a sin for embattled ruralites to cut the crop even by fifteen per cent. I am convinced that hair dye and wigs will be in demand among the county agents this year or else we will have plenty of gray locks and shiny pates among them.

YET my thesis is that the whole business, despite the grief and gunplay, has been a good boost for the system. The service depended primarily on the welfare of agriculture and it could not last through a few more years of poverty and dismay. The team-work between county agents and specialists and the farmers developed in these later seasons ought to command mutual respect in most cases. Yes, and even some of the disgruntled small-town tradesmen have turned around and thanked the extension workers for saving their bacon for them, which is the capsheaf of reward. Here for once it was proven that a mighty strong army

(*Turn to page* 45)

Alsike Clover, 1933, Livingston Farm

LNPK
Av. yield 3415 lbs.

LP
Av. yield 1715 lbs.

Conn. Valley Soils Need Potash

By Ford S. Prince

Agronomist, New Hampshire Agricultural Experiment Station

NO other farming region in New England is better known than the Connecticut Valley. Forming the boundary between New Hampshire and Vermont, this river, flanked as it is by flood lands and broad smooth terraces, flows on to the sea forming the very agricultural heart of Massachusetts and Connecticut. Huge crops of onions, wrapper tobacco leaf grown in shade and in the open, vegetables, dairy products and forage crops, these and many others are grown on this comparatively narrow strip of land which is justly famous.

During past ages the waters of this river have been developing the different terrace levels which now form the farming lands of its beautiful valley. Sand, silt, and other soil components have been brought from the hills of these states through the tributaries of the river at flood tide to be deposited into new soil when the flood waters have receded. This material has come from limestone valleys in Vermont, and from the glacial deposits of New Hampshire and the other states. That

the river has not yet finished its work was amply demonstrated in November 1927, when deposits of sand and silt were laid down in many places to a maximum depth of two and three feet.

With such a variety of parent materials to draw upon, it is little wonder that the soils in this great melting pot present certain variations from other lands in the states bordering the river. Flood deposits investigated in New Hampshire after the 1927 flood revealed the fact that these newly laid soils were the only ones in the whole state that carried sufficient lime and other alkaline materials to raise the test up to or above the neutral point, and that instead of ruined land, these new deposits were, in many respects, actually more fertile than the underlying soils which they had so deeply covered.

Show Need for Potash

Such is a brief resumé of the history of Connecticut Valley soils. Chemical studies which have been made on the soils of one of the terraces of the valley show that the need for lime is less and the need for potash greater than on other soils of the rest of New Hampshire. It is quite probable that this will hold true of the whole valley in comparison with the other land in the bordering states, if an exception is made of the limestone valley soils wherever they occur.

That these soils respond to potash more than certain other lands in New Hampshire is illustrated by certain comparative data with sweet clover. Of the legumes, sweet clover appears to be better able to rustle its potash from the unavailable supplies in the soil than most other crops.

In an experiment covering yields of two crops of sweet clover at Greenland, N. H., the addition of potash to a manure, lime, and phosphorus treatment gave no increase in yield. On the Connecticut Valley terrace where data have been taken on yields of this same crop for two different years, all the treatments with potash scored tremendous increases, the stimulation from 150 pounds of muriate of potash being greater than that from 10 tons of manure.

The case for phosphorus is exactly reversed. Slight increases in the yield of sweet clover in the Connecticut Valley were not significant, while good stimulation was produced in sweet clover at Greenland from generous applications of superphosphate.

With sweet clover behaving so differently on the two soils, and indicating as it does a vital need for potash, it is not surprising to find that other crops give a tremendous response to potash in the valley of the Connecticut.

In the same field where sweet clover was grown, a mixture of alfalfa and timothy was seeded in 1929. Data covering five cuttings in three years are now available. The first year the crop was harvested, the stand was largely alfalfa. The second season's crop was about half alfalfa and half timothy, while the third year's stand was almost wholly timothy.

It was no surprise when alfalfa responded to potash, but when the increases were well maintained on the timothy crop after the alfalfa had largely killed out, it was rather astonishing, yet this is just what happened.

A summary of the results with this mixed hay combination is well illustrated by the table which follows, where the average response for all the different possible combinations is given for each substance used as a fertilizer.

Material Used	Increase, Lbs. Hay per Acre
100 lbs. Muriate of Potash	1200 lbs. Hay
100 lbs. Nitrate of Soda	750 " "
100 lbs. Superphosphate	185 " "
1 T. Ground Limestone	2600 " "
1 T. Manure	225 " "

These figures represent the response for five cuttings and include the har-

vests when alfalfa made up most of the stand as well as those when timothy was more abundant. While all of the materials mentioned were used at a profit, potash gave the greatest return on the money invested. At a valuation of $15 per ton for the hay, a fair average during the period studied, and using the mean cost of the materials applied, one dollar invested in potash returned $3 in hay, while one dollar invested in nitrogen and phosphoric acid returned $2.25 and $1.39 respectively. Lime brought in $2.80 for each dollar spent, and manure paid back $1.69 for each ton used. At present costs, the money return for potash and nitrogen would be considerably higher on account of reduced costs for these materials.

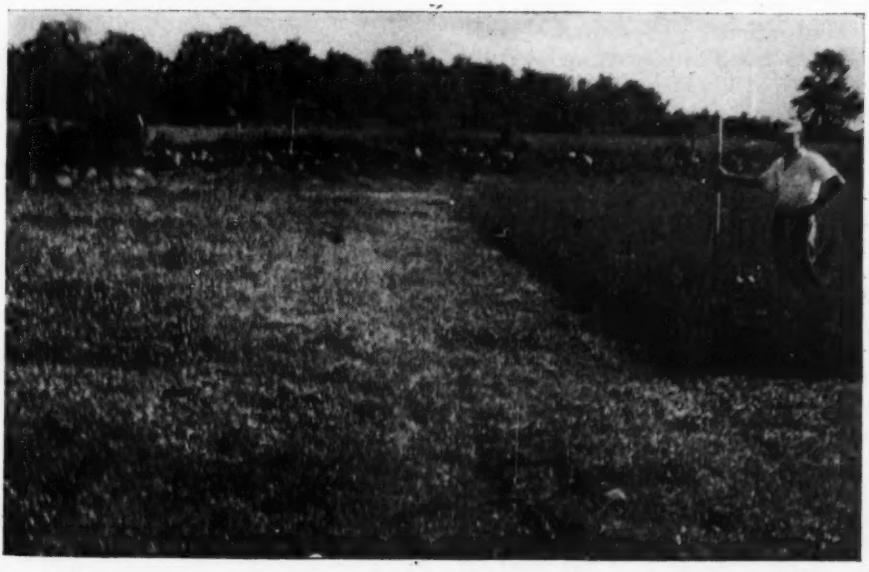
After plowing the land where the alfalfa-timothy plots had been in the summer of 1932, an August seeding of red clover was made. The plots which, during the same years had produced sweet clover, were seeded to alsike clover at the same time. No additional lime or manure was used, but the plots were top-dressed the following spring with the fertilizer variations as in previous years.

On the plots that had received no potash, both alsike and red clover made a very unsatisfactory growth. Taking the yields from the red clover plots as an example, the average growth produced by four treatments without potash was 1026 pounds of cured hay, while six treatments with potash responded with 3394 pounds of hay, more than three times as much.

It would, of course, be unfair to say that all of this wide difference in yield is due to the potash used. In fact, there is much evidence in the data to prove that available phosphoric acid is of great importance as well. The entire mass of data is too long to be submitted in a brief summary of these tests, but the following table will serve to show what happens when these two elements are hitched up.

Treatment	Red Clover Hay
Average yield 12 checks....	668 lbs.
500 pounds Superphosphate.	1276 "
150 pounds Muriate of Potash	2177 "
500 Superphosphate + 150 Muriate of Potash...	4005 "

(*Turn to page* 38)



Check
Av. yield 965 lbs.

Alsike Clover, 1933, Livingston Farm

LNPK
Av. yield 3413 lbs.

The Inquiring Mind *and the* Seeing Eye

By Dr. A. S. Alexander

University of Wisconsin

THE source, composition, character, and qualities of the soil have intrigued Andrew Robeson Whitson ever since the days of his childhood on his father's 600-acre farm in southeastern Minnesota. His inherent bent in that direction, enhanced and cultivated by practice and education, led inevitably to the adoption of soil science or pedology as his specialty and brought him, in time, the position of Professor of Soils in the University of Wisconsin, which he has filled with credit since 1901.

His intimate acquaintance with "Mother Earth" began at an unusually early age of his life, for when he had just turned seven years of age, he might have been seen proudly driving three sturdy work horses hitched to one of the first Bradley steel riding plows used in Minnesota, and turning over a 16-inch furrow of rich, black prairie soil. His father had marked off an 80-acre "land" with rounded corners for his initial efforts, and "round and round" it went the team and embryo soil scientist until the wheat stubble was covered and a fine seed bed provided for the succeeding crop. Nothing could stay or stop that red-headed boy, whom the folks and neighbors nicknamed "Gritty." He accomplished the task set him with the indomitable persistence he had inherited from his Scottish ancestors, and the ability for persistence and plodding that has characterized him from that day to this.

All farm boys in those pioneer days on the prairies of the northwest early learned how to work willingly and well. They began with the lighter chores of the farm, soon learned to milk, and then to work horses in the field. This labor, while sometimes irksome no doubt, developed fine traits of independence, efficiency, and resourcefulness in farm boys like "Gritty" Whitson. It is not surprising, therefore, that perched high on the spring seat of a Studebaker wagon, when but 10 years old, he drove one of the teams hauling wheat from the home farm near Stanton, Goodhue county, to the Red Wing elevator 28 miles away on the Mississippi.

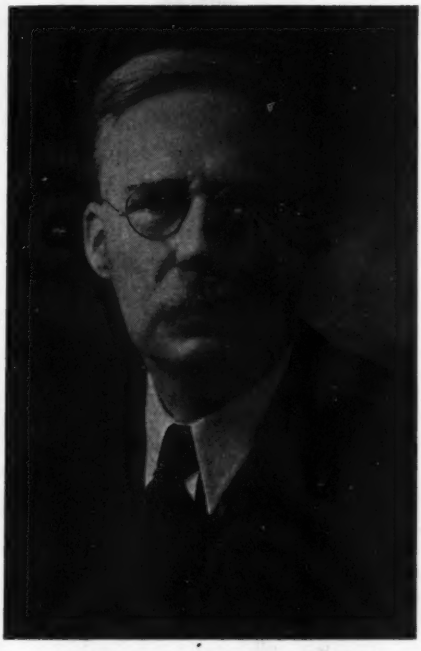
Inherited Will to Do

In those early days, from the sixties to the eighties, spring wheat reigned supreme as the pay crop in southern Minnesota and the Red River Valley. It was largely of the red Fife variety and produced 40 bushels or more per acre at first, and even 30 to 35 bushels an acre at the time of "Gritty's" hauling; but then, alas, the devastating chinch bugs descended, ruined the wheat crops, and drove the grain growers into the dairy business.

Those, too, were the days when

flocks of wild passenger pigeons sometimes shrouded the sun as they flew over the Whitson farm, but man murdered them and the white pine forests of the north and now they are no more.

It should not be understood, however, that Andrew Whitson's father, also called Andrew, was a hard task-



PROFESSOR A. R. WHITSON

master. On the contrary, he insisted that the boy should faithfully attend the country school, and do his chore work early and late enough to permit of that. The old man had worked strenuously to acquire his great farm since coming to Minnesota in 1863 with his wife, Abigail Dack Whitson, from the famous Glengarry Country in Canada where they were born. Young Andrew's ancestors were Scots. In 1907 he succeeded in finding the home his grandfather, a Master Mason, had built in Edinburgh, Scotland, of which city, a few years ago, a Whitson was Lord Provost. His grandmother was Ann Alexander, whose father was an instrument and clock maker of Hull, England. One of the most prized treasures in Professor Whitson's home today is the fine grandfather clock, with its mellow-toned silver bell, which Grandfather Alexander made and presented to his daughter on the occasion of her marriage. Another antique of particular interest is the Whitson family Bible which is some 300 years old.

Andrew Robeson Whitson was born on the farm near Stanton, Minnesota, October 9, 1870. On the home farm young Andrew did the practical work we have mentioned, and his rudimentary education was acquired at the nearby country school. When he was 11 years old the family moved to Northfield, the seat of St. Olaf and Carlton colleges, so that the children might have better educational advantages. There he finished the work of the public school and had three years of preparatory work in Carlton College.

Early Interest in Geology

On the home farm he had made a collection of rocks and plants, and having become interested in geology and botany, he naturally made these studies his specialty at Carlton, in preference to the Greek and Latin to which, at first, the college professors directed his attention. Gradually he became so interested in the study of rocks that he decided to further his knowledge of geology in the University of Wisconsin. In that institution he took the first two years of the course in General Science and especially the courses in mineralogy and geology under Professors Hobb, Salisbury, and Chamberlain.

When the University of Chicago was opened, in the autumn of 1892, and attracted President Chamberlain and Professor Salisbury to its faculty, young Whitson went with them and continued his studies in geology and other sciences. For two summers he was engaged in the work of the U. S. Geological Survey in Pennsylvania and

New Jersey under their direction. In 1894, he received the Bachelor of Science degree from the University of Chicago. His first year of graduate work was largely devoted to Geology and Chemistry; then, in 1895, he became Principal of the High School of Beloit College, Wisconsin, and instructor in science there.

In 1897, he married Miss Louise Josephine Fitch. They have three children.

After serving in Beloit College for four years he was appointed Assistant Professor of Soil Science in the College of Agriculture of the University of Wisconsin, and was advanced to a full professorship in 1901. He had worked with Professor F. H. King of the University of Wisconsin during two summers while connected with Beloit College, doing chiefly research with that eminent scientist on the flow of water through sand and the soil.

Pursued Graduate Study

It was that experience which led to his invitation to join the faculty of the Wisconsin College of Agriculture in 1899, and he was also given the opportunity for an additional year of graduate study in the University of Chicago. When Professor King was attracted to the U. S. Department of Agriculture at Washington in 1901, Professor Whitson was appointed his successor in the Wisconsin College of Agriculture, and there he is serving today in an unassuming, but purposeful and highly successful way.

His first sabbatical leave of absence, granted in 1907, was used for further graduate study in Berlin and a study of soil management during the following summer in Germany, Austria, Italy, Holland, and England. During that year he was appointed by Secretary of Agriculture James Wilson, U. S. Delegate to the International Congress of Agriculture in Vienna.

Professor Whitson is a charter member of both the American Society of Agronomy and the American Association of Soil Survey Workers. In 1933 he was elected a member of the American Geological Society of New York, and a fellow of the American Society of Agronomy. He is also a member of Sigma Xi and Alpha Zeta.

When Professor Whitson began work in agricultural physics at the Wisconsin Agricultural Experiment Station in April, 1900, methods of rapidly determining nitrates in field soils were perfected and determinations made, throughout the growing seasons of 1900 and 1901, on the soil under all major Wisconsin crops. These were, we believe, the first systematic determinations of nitrate development and use by crops under field conditions. In 1902 and 1903, further studies showed that plants growing on soil having a high content of nitrates or available nitrogen produced crops with a higher protein content than those growing on soil poorly supplied with available nitrogen.

From 1900 on, Professor Whitson also studied the fertilizer requirements of marsh soils in various parts of Wisconsin. He found that while potash was the element chiefly lacking in the peat soils of the limestone region, those of the central and northern districts, which are acid, also lacked phosphorus and lime. Studies of the methods of applying fertilizers were undertaken in 1902.

Found Many Soil Problems

Difficulties in cranberry growing next attracted Professor Whitson's attention, and in 1903 work in cooperation with the Department of Horticulture was begun. The work showed that frost on peat land was chiefly due to its poor conductivity rather than to air drainage, which meteorologists had assumed to be the cause on low ground. A light layer of sand was found to reduce and in many instances entirely prevent injuries by frost. The differences in temperature in the zone of the cranberry vines on sanded and unsanded land often was

(*Turn to page* 40)

Micro-chemical Methods As *an* Aid *in* Studying Soil Fertility Problems

By Jackson B. Hester

Soil Technologist, Virginia Truck Experiment Station

AGRICULTURE at the present time is engaged in a most difficult struggle. What has happened to this industry during the past few years, together with the situation which confronts it at present, compel the most enthusiastic grower to pause and consider some of the problems involved in the economic production of a crop. If he is to emerge successfully, the most intensive farming methods must be used.

During the past the element of crop failure through neglect has been all too great, and methods to control and correct these conditions must be followed. It has been admitted that many lands not suitable for crop production, due to depleted nutrient content, poor physical condition, and improper fertilization, have reduced the operators to poverty. In order to bring agriculture out of the mire, these things must be corrected. It is believed that the short-chemical methods now being developed, in the hands of the properly trained man, can most definitely help to do this.

The crop-producing power of a soil must be considered to be a combination of many factors. For convenience they may be evaluated by stating that productivity depends upon such factors as (1) weather, (2) plant disease, (3) cultural methods, (4) soil reaction, (5) organic matter, (6) available nutrients, (7) texture and structure of the soil. The first factor, although a most potent one, is beyond our control. The second one can be minimized by crop rotation, seed treatment, etc. For the remaining, more or less definite aid can be given. The interdependence of soil reaction, organic matter, available nutrients, and texture as an aid to studying soil fertility problems will be considered as developed by the quick chemical tests.

Soil Solution and Extracting Reagent

Soil chemistry has advanced a long way since chemical methods were first used in its study. Indeed, much water has passed under the bridge since Milton Whitney (1892) put forth the view that plants obtained their nutrients from the ions present in the soil solution. Around this idea he built an elaborate theory of soil fertility, much of which has proven unacceptable. Still, the hypothesis that the soil solution is the culture solution of the plant is now accepted. The quality of the soil solution is greatly affected when the soil is limed or soil amendments are applied, etc.

The method that one employs in studying soil fertility should be gov-

erned by the cropping systems and soils concerned. At least some idea as to what soil constituents are being affected by the extracting reagent must be at hand. This can only be learned through established methods of research embodying plant growth as well as chemical studies. Once this has been established for a given set of soils within a particular locality, the method becomes quite valuable. The soil solution contains the whole of the nitrate readily available to the plant, some of the calcium, magnesium, and potassium, but only a fraction of the phosphate.

No definite proportion can be set to include all soils, but broadly 40 to 250 parts per million of nitrate, 10 to 40 of potassium, and from 1 to 2 parts of phosphate are found in the soil solution. While the most fertile soils generally analyze the highest in these ions, the renewing power of the soil is exceedingly important and dependent upon the composition of the soil and the activity of the soil microorganisms. So, at the best, an extracting reagent can only approximate these conditions. From a knowledge of the renewing power of the soils involved and the nutrients present, one can predict what is to happen for a short time at least. From this standpoint the use of a dilute extracting reagent seems well founded. Whichever method is employed, a dilute acid salt solution or a more acid mixture, it becomes more valuable to one as he gains information of the soil condition, soil constituents affected, and cultural practices of a given community. The weak points of the methods are also learned and likewise their application becomes more valuable.

In studying the soil fertility problems at the Truck Station, we have employed a comparatively dilute solution of sodium acetate buffered to pH 4.8 to 5.0. It is prepared by dissolving 10 grams of sodium hydroxide in water and adding 20 milliliters of acetic acid, giving a final volume of two liters. Ten grams of soil are extracted with 25 milliliters of this solution and from the extract phosphorus, potash, magnesium, ammonia, nitrate, etc. can be detected. The reason for employing a comparatively dilute solution is that vegetable crops make a very rapid growth in a very short time. Thus, abundant plant nutrients must be present in a readily available state if the plant is to get sufficient for rapid growth.

Phosphate Availability

The Norfolk trucking area has been farmed since 1700 and trucked since 1844. Large quantities of fertilizer have been applied to the soils, affecting them in many ways. For example a large phosphorus reserve has been built up in the soil. This is readily understood when it is realized that from 100 to 160 pounds of phosphoric acid are generally applied in the growing of a crop of Irish potatoes, whereas only 12 to 15 pounds are actually utilized and less than this amount actually removed from the

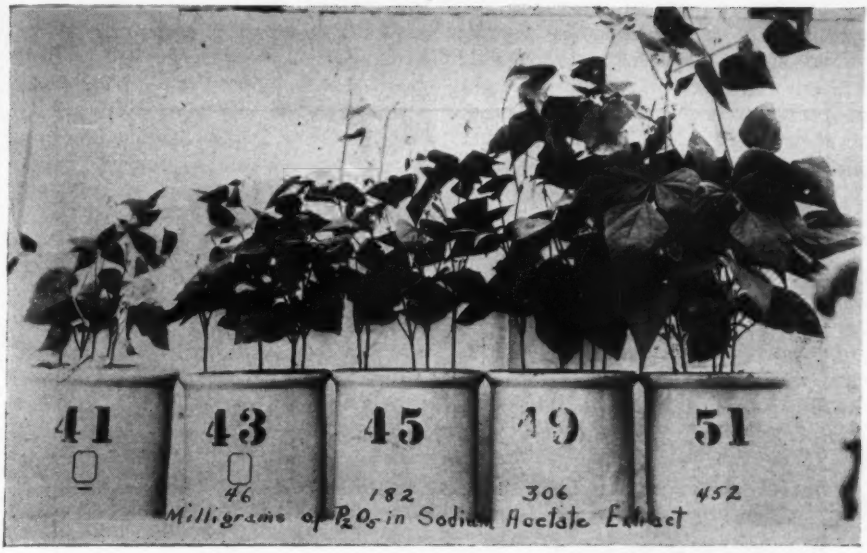
Table 1

THE INFLUENCE OF SOIL ACIDITY UPON THE AVAILABILITY OF PHOSPHORUS

Norfolk Sandy Loam

	p.p.m. of P_2O_5 in soil*						
Water Soluble	0.8	1.4	1.9	2.0	2.0	1.9	1.8
Sodium Acetate Soluble	2.0	3.5	5.5	8.0	9.0	9.0	9.0
Soil pH	4.4	5.0	5.5	5.9	6.2	6.4	7.0

* *Soil analyzed* 0.15 *per cent* P_2O_5*—not fertilized within one year of tests.*



Growth of beans in phosphorus test—shown in Table 2.

soil. Very little is leached from the soil, so from year to year this has accumulated. Many factors influence the availability of phosphorus, notably the soil reaction and organic matter content.

The effect of soil reaction is brought out most strikingly in Table 1. Here also is shown the relation of water-soluble to sodium-acetate-soluble phosphorus. Phosphate fixation is very great on the acid soils. Indeed, the yield curves on these plats closely follow the available phosphate curve. This clearly shows that a knowledge of the fixing power of a soil for phosphorus is very important.

The fixing power of a Norfolk fine sand is possibly best shown in Table 2. This experiment was run to study the phosphate-fixing power of the local soils. The pots received the initial application of phosphoric acid from superphosphate as shown in the table. Each pot received an abundance of potash and nitrogen with the variable supply of phosphorus. The beets did not show such a great difference in yield to the high applications of phosphorus as did the beans. This was due to the fact that the beets were planted immediately after the application of phosphorus and the soil had not had a chance to fix the phosphorus.

Table 2

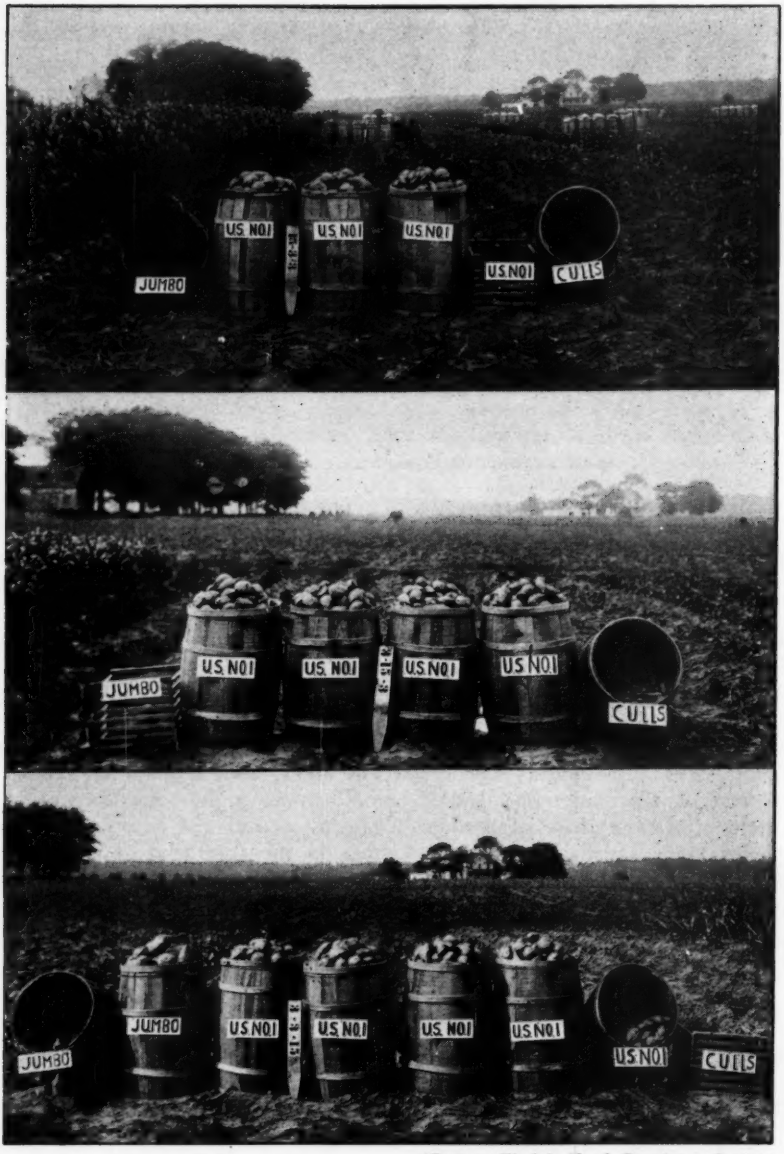
PHOSPHORUS TEST IN GREENHOUSE

(Norfolk fine sand)

Yield in Grams Increase Over Check and P_2O_5 in Milligrams Per Pot

P_2O_5 Added 2/5/34	Yield of Beets 4/10/34	P_2O_5 Absorbed* by Beets	P_2O_5 Leached 4/9/34	P_2O_5 in Sodium Acetate Extract	Yield of Beans 6/11/34	P_2O_5 Absorbed by Beans
500	11.8	97	0.5	46	3.4	13
1000	14.4	158	1.4	182	8.9	42
2000	12.6	162	1.6	306	13.3	81
4000	19.7	339	11.0	452	20.2	180

Study run at pH 6.2. * *Minus that absorbed from the natural soil.*



(Courtesy Virginia Truck Experiment Station)

Yields of sweet potatoes from one-twentieth acre plats in 1926. Top 15-3-3. Middle 3-15-3. Bottom 3-3-15. Reference to Table 3.

Eleven weeks elapsed between the time of planting the beets and the bean crop. One day before the harvest of the beet crop, soil samples were taken for analysis and then the soil in the pots was leached with about the equivalent of two inches of rain water. The sodium-acetate-soluble phosphorus was obtained from the soil samples and the drainage water also was analyzed.

Quite a close correlation was noted between the phosphorus shown by the sodium-acetate extraction and that absorbed by the crops. From this it is believed that an extracting reagent that most closely correlates with that absorbed by the plant is more valuable than one that shows more nearly what has been added. It has been our experience with some of the more acid extracting reagents, found to work in some parts of the country, that a high test for phosphorus is found in most of our soils. This, I believe, is explained by the nature of the compounds in the soil affected by the extracting reagent. It is not practical to use water extracts of the soil because of the time-consuming element.

Potash Availability

While some soils show a comparatively high power for fixing potash in a difficultly available form it is far less than the fixing power of some soils for phosphorus. Likewise, crop utilization is much higher. A crop of potatoes, while it utilizes only from 12 to 15 pounds of phosphoric acid to the acre, will utilize from 50 to 75 pounds of potash. In this connection, the data in Table 3 are interesting. These data were taken from the long-time fertility plats located at Onley, Virginia. The yield data are given to explain the test for available potash.

The wide ratios used in this work serve to provide significant differences in soil treatment against which to compare micro-chemical methods of testing soils. The yields also show the importance of properly balancing the fertilizer according to the crop needs as well as soil deficiencies.

Even though considerable potash from the high-potash plats had been removed by large crops of sweet potatoes, the test for available potash gave some correlation with the amount applied and also some correlation with the total replaceable potash found in the soil. The results indicate that even though large amounts of potash have been applied in the second treatment over a period of years, there is not enough left in an available state, as shown by chemical tests, to grow a good crop of potatoes without the usual fertilization.

The soil tests have been very valuable in this section in locating fields that are likely to show magnesium deficiency in potatoes. Almost without exception soils that have shown magnesium-deficiency symptoms in the field have given a poor test for magnesium in the laboratory. The aluminum test has likewise aided in

(*Turn to page* 42)

Table 3

POTASH TESTS ON FERTILIZER PLATS

Sassafras Sandy Loam

Fertilizer used 12 Years	K_2O p.p.m. of Soil			Bushels per Acre		
	Total Applied	Replaceable in Soil	Sodium Acetate	10 Yr. Av. Irish Potatoes	9 Yr. Av. Sweet Potatoes	5 Yr. Av. Corn
15-3-3	186	71	10	158	206	45
6-9-6	558	78	20	172	241	43
3-3-15	930	190	140	92	289	31

Muck-grown Potatoes Can Top the Market

By E. B. Tussing

Extension Horticulturist, Ohio State University

THE prejudice against "muck" potatoes is no longer justified. It still exists on many markets; but if the potatoes are properly grown and cleaned, they often will bring a premium in these same markets because their identity as muck-grown is lost. I have seen them bring a 10 per cent premium in our Ohio markets.

For years the buying public has discriminated against muck-grown potatoes, which have had a displeasing appearance caused by the adherence of the soil and which have tended to be soggy when cooked. In many instances the growers did a haphazard job. The potato crop was secondary and was planted only after the wind had destroyed the onion crop and it was too late to reseed. This method of growing did not add to the quality. Low quality is generally associated with poorly drained muck and the insufficient use of potash fertilizer.

Cleaning Stimulates Buying

Interest in potato growing on the muck is being revived since the introduction of cleaning machinery and the better quality to be gained through proper drainage and fertilization. This is particularly true in New York, Ohio, and Indiana. No doubt some of this interest is due to the low prices that other muck crops have been bringing on the market, and some to the stimulated buying of cleaned muck potatoes. Labor problems may have an influence on the shift because less labor is needed to grow a good crop of potatoes than is required in producing many of the other muck crops, especially those that have to be hand weeded.

The growing of potatoes on muck involves a number of problems but probably the most serious are drainage, proper fertilization, frost damage, scab and Rhizoctonia, digging injury, and the cleaning of the tubers. It is essential to good quality to have the muck well-drained. Frost damage is a serious problem and about the only control that can be practiced is an adjustment of planting dates. It is essential that potatoes be planted as early as possible and still avoid serious frost damage.

Early Planting

Three years of work at the Muck Experiment Farm at McGuffey, Ohio, show that early May plantings have been yielding better than the later ones, if they escape June frosts. Cobblers planted in 1934 on May 4 yielded 433 bushels while those planted on May 22 yielded 322. White Rurals planted May 4 yielded 470 bushels as compared to 371 for the May 22 planting. There was but slight difference in the yield of White Rurals planted May 22 and those planted June 7. Those planted June 20 yielded 190 bushels and were immature when killed by frost on September 28. The years of 1932 and 1933 were seasons with severe June frosts,

hence the early May plantings did not appreciably out-yield the later plantings.

The amount of damage will depend to a large extent upon the number of rotten seed pieces. If cut potatoes are used and the seed piece fails to heal properly, recovery of the plants cannot be expected. It is essential when planting early on muck that the seed pieces be intact after the plant has been frosted. To be sure of this, it is advisable to use small whole certified seed or to heal the cut seed.

A 100-acre field of potatoes growing on muck in Hardin county, Ohio.

There is nothing definite to offer in the way of controlling scab on muck except to recommend the use of an acid fertilizer instead of one that leaves an alkaline residue. Of course, many mucks are sour and some of them to such a degree that it is necessary to add lime to grow a profitable potato crop. Growers having a sour soil are fortunate. No inexpensive method for reducing the pH of muck soils has been developed.

Rhizoctonia on muck is oftentimes serious. Shallow planting will help control Rhizoctonia but shallow-planted potatoes on muck will be badly sunburned. Plots in Ohio showed that deep-planted seed on muck is subject to considerable Rhizoctonia injury and that there is no advantage in planting more than four inches deep. To plant deep and still get shallow covering, the discs are removed from the planter, the seed put down to the required depth, and only an inch to one and one-half inches of muck pulled over the seed. After the sprouts come through, the trench is filled by running the weeder over the ground. This will help control the Rhizoctonia from girdling the plants, but it does not prevent the tubers from being spotted.

Rhizoctonia on the tubers shows very plainly when the potatoes have been brushed. I know of no successful method to prevent this trouble. One of our large growers on the muck this year used the hot formaldehyde treatment on his seed. He seemed to think that it helped some. At the Experiment Farm, an attempt has been made to secure seed quite free from Rhizoctonia and this has been planted without being treated. I think the control has been as good as with treated seed.

Because of the short growing season on the mucks, potato varieties used should be those that have a short growing season. The white-skinned potatoes, while more susceptible to scab, are more attractive than the thicker skinned russets.

The Irish Cobbler is the best early variety we have found and is to be highly recommended for muck. For the intermediate crop, two varieties can be recommended—the late Cobbler which is similar in all respects to the Irish Cobbler except that it matures two weeks later, and the Katahdin, a new variety introduced by the United States Department of Agriculture. The Katahdin matures about the same time as the late Cobbler but has a distinct advantage of being a smooth, round, white tuber which cleans readily. It has yielded well and is recommended for trial. It should be spaced in planting to avoid large tubers as the large tubers tend to have a very deep bud end. Seed is available in small quantities. The new Chippewa, also introduced by the United States Department of Agriculture, was tried this year and gave promise of being a good variety for muck. The tubers are similar to the Katahdin but are somewhat earlier. Seed of this variety is not available in quantities as yet.

Certain strains of white or smooth rurals can be recommended for the late crop. At least three strains that yield as well as russet strains have been found among those tested in Ohio. Rurals are more resistant than Cobblers to injury from leaf hopper and flea beetle; therefore, do not require as thorough spraying. Rurals mature so late that they are usually green when hit by frost. Another weakness is a tendency to large growth cracks in favorable seasons.

Potash in Large Quantities

Three years' fertilizer results are now available at our muck farm. The muck there is 30 to 36 inches deep and has a soil reaction of pH 5.7. Severe frost injury in 1933 in the fertilizer plots materially reduced the yields. The three years' results show that the omission of either nitrogen or superphosphate has resulted in a small reduction in yield just sufficient to indicate that these elements are required in small amounts. Potash in large quantities is required for high yields.

1934 *Potash Results*

Fertilizer *	Yield per Acre
3-9-0	165 Bus.
3-9-9	344 "
3-9-18	416 "
3-9-27	487 "
3-9-36	509 "

* *Application—750 Lbs. per Acre.*

The fertilizer practices used on new and old muck would naturally be different. Seldom does new muck need any commercial nitrogen, but it is usually deficient in potash and phosphoric acid; while old muck will need a small amount of nitrogen and if heavily fertilized, may have a carry-over of potash and phosphoric acid.

Spraying, Irrigation, Etc.

Potatoes on muck should be spaced so as to prevent oversized tubers. Spacing of 32 to 11 inches have proved satisfactory. Since plantings are usually made later on the muck than on the upland, seed pieces develop more sprouts. This results in a heavier set; and closer spacing than 11 inches is not necessary to keep down the size of the tubers.

While no spraying demonstrations have been conducted, observations show that more adequate spraying is required on the muck than is required on upland. The tops grow so fast that 10 days to 2 weeks spraying fail to cover some of the leaves.

Inadequate spraying was particularly noticeable when June frosts killed part of the foliage. When part of the tops are killed, the insects concentrate on the uninjured leaves, some of which are not covered with spray. In 1933, after a frost these lower leaves were so heavily infested and the injury so great the plants failed to recover normally and the yield was greatly reduced. Weekly spraying this year gave excellent control.

Both overhead and sub-irrigation

(*Turn to page* 46)

The Humus Front

By Dr. R. E. Stephenson

Oregon State Agricultural College

AMONG the various fronts upon which Civilization is fighting is the "New Humus Front." Reduced crop yields, in spite of a greater use of commercial fertilizer, are due to an increasing lack of humus in long-farmed soils. With the loss of humus the "old force" is gone out of the soil.

In this country we are yet farming comparatively new land. Yields on the average have not fallen. In fact a slight increase, due to many causes such as better methods, more and better fertilization, better seed, etc., is probable. But we are concerned about the humus economy of our soils. Those soils in which the humus has become depleted are not as productive as in their virgin state. Dry years are increasingly disastrous because of lack of humus. We have some worn-out soils. The humus is gone or going rapidly in too many soils.

Market gardeners find it increasingly difficult to secure stable manure. The family horse of the city is no more, and manure from the city is scarce and high priced. The stockyards and feed lots supply an inadequate amount. What is the solution of manure shortage?

Part of the solution to date has been the increased use of commercial fertilizer. Not four or five hundred pounds but four or five tons per acre are sometimes used in the attempt to boost yields and produce quality crops. With irrigation, which supplies the moisture, the possibilities of fertilization are illimitable, but soil fertility can never be maintained without due consideration of humus renewal. Drouth years are doubly destructive as the humus vanishes, and many seasons have drouth periods when lack of humus adds to the handicap of lack of water.

Green manuring is an effective means of humus renewal, and orchardists are making increasing use of green manure crops for supplying humus. The liberal use of commercial fertilizers to grow an abundance of humus is a sound practice. Orchards and even individual trees produce and are profitable somewhat in proportion as humus is renewed.

Truck farmers are using green manures, but not as whole-heartedly as

(*Turn to page* 44)

In Aroostook county, Maine, great crops of clover are plowed under to furnish humus for maintaining potato yields. This close-up shows the soil scraped away and the decaying mass of clover.

Black Locusts Will Anchor Sand

By A. F. Gustafson

Professor of Soil Technology, New York State College of Agriculture

ABOUT 25 years ago the late Frank Markert planted black locust sprouts on some dune sand on his farm which is located near Bath, Mason county, in Central Illinois. This county alone has 75,000 acres of more or less shifting dune sand, and this acreage constitutes 21 per cent of the area of Mason county. It was while a field party under his direction was making the soil map of this county that the writer became interested in the possibilities of growing the black locust on this immense area of dune sand.

Easily Established

While planting locust seedlings and pine on some additional acreage of this dune sand, the writer's attention was attracted to the mat of organic matter under a thick stand of the trees growing from the original planting of black locust sprouts made a quarter of a century earlier. The reason the sprouts had not attained saw-log size during this period is that fires have gone through the plantation many times, averaging once in three or four years. The last fire occurred in 1931, three years previous to the time of this observation. The heat from these fires is so intense as to kill nearly all of the locust growth above ground, particularly the smaller sprouts.

Samples of the organic material collected in such a manner as to represent a given area were taken to Ithaca, New York, for examination. Dry matter, loss on ignition, and percentage of nitrogen were determined. The loss on ignition indicated more than 1.1 tons of organic matter on the water-free basis or more than 1¼ tons of air-dry organic matter. This material which had accumulated during the three years since the last fire, including some sand, weighed 8,695 pounds and contained 1.2 per cent or 101 pounds of nitrogen over an acre. Surely it is a crime to permit the destruction of so much organic matter and nitrogen and the killing of the above-ground locust growth as well.

It was notable that under these locust trees absolutely no movement of sand occurred owing to the surface covering of leaves. A similar situation, no doubt, obtains under ordinary forest trees. The difference lies in that the locust, owing to the fact that it is a legume, can be established readily on dune sand which is almost free of nitrogen.

Conserve Adjacent Soils

During this period in April, 1934, the writer observed the effects of three days and nights of continuous strong wind. Much of this dune area supported what would be regarded as a fairly good cover of tall bunchy grass. A continuous grass cover would, of course, hold sand movement to a minimum, or, in fact, practically prevent any movement, whatever. During this strong-wind period, how-

(*Turn to page* 38)

Pictorial

"I WISH I COULD HITCH A HORSE TO THIS GOL-DARNED THING"

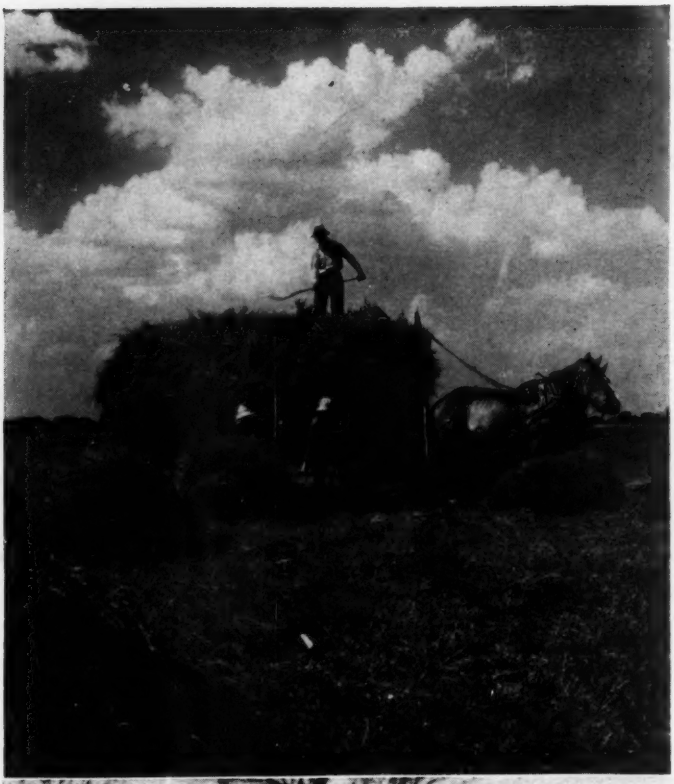
Left: Competition is the basis of many of the summer pastimes of city children. This sailboat regatta is being held in Central Park, New York.

Ewing Galloway, N. Y.

Below: Cooperation to meet competition is also taught young muscle builders in the crowded city playgrounds.

Above: Farm children often lack playmates, but self-reliance at an early age finds many opportunities for development.

Right: Responsibility, frequently thrust upon farm youths of tender years, is tempered by wholesome and interesting surroundings.



It's hard work, but "hustle" at certain times to insure good quality hay means—

profit in animals like these when they are ready to be finished for the market.

The Editors Talk

American Potash Institute, Incorporated

On May 28, 1935, the American producers and importers of potash salts announced the organization of the American Potash Institute, Incorporated, to be established in Washington, D. C. "In view of the growing importance of potash in the agriculture of North America and in order to lend assistance in this nation's fertilizer research program," the organizers said, "the Institute has been organized to carry on scientific and agricultural investigations to promote the efficient and profitable use of potash in crop production. It is recognized that an increasing and effective use of fertilizers, including potash, can only be based on facts resulting from scientific work.

"It will be the policy of the Institute to cooperate, as opportunity affords, with State and Federal institutions in carrying on research and experimental work in the United States, Canada and Cuba, and with the agricultural work sponsored by the National Fertilizer Association and other scientific and trade organizations."

Dr. J. W. Turrentine, for years past in charge of Potash Researches of the Bureau of Chemistry and Soils, U. S. Department of Agriculture, has been appointed President and Treasurer. G. J. Callister, for 24 years connected with the educational work of the potash industry, is Vice-President and Secretary.

Better Crops With Plant Food

Beginning with this issue, BETTER CROPS WITH PLANT FOOD is to be published in the interest of the policies of the Institute. Our editorial offices will be in the Investment Building, Washington, D. C. Sid Noble, who has been associated with BETTER CROPS WITH PLANT FOOD, is remaining with one of the potash producing companies and will no longer be connected with the magazine. Upon severing his services, Better Crops Publishing Corporation wishes to express to him its appreciation and its good wishes for his future.

The policy of the magazine will remain unchanged. More than ten years ago in several issues we emphasized our aims and purposes. It may be well to quote from one of these statements:

"In developing a more efficient agriculture, you believe—as we do—that one of the most important factors is sound research and experimental work. It is our policy, therefore, to actively support all groups and agencies doing such work, especially the State Agricultural Experiment Stations and Colleges, and the United States Department of Agriculture.

"We believe that such research work is of the greatest value when translated into more efficient production and better living on the farm. Agriculture should be put on a business basis. The farmer is entitled to a larger

share of the consumer's dollar. Living and working conditions on the farm should be improved. Consequently we are glad to heartily support the work of the agricultural extension forces and the county agricultural agents.

"Especially do you want all the facts, not selected facts. It is therefore a very vital part of our policy to publish all the facts. You want these facts presented by authorities in an easy-to-read and attractive form. To combine a soundness of purpose with brightness of treatment is one of our chief aims."

That this policy has borne fruit, we believe, is evidenced in the many friends which we have made and our steadily increasing number of readers. We appreciate hearing from our readers and to have you make us a forum for exchange of ideas, opinions, and experiences. In return we pledge that we will constantly strive to make BETTER CROPS WITH PLANT FOOD interesting, attractive, and at all times thoroughly dependable.

International Cooperation

One of the most striking examples of international cooperation is being called to public attention in the Third International Congress of Soil Science to be held in Oxford, England, from July 30 to August 7, 1935, under the Presidency of Sir John Russell, Director of the Rothamsted Experiment Station, England. Following the initial Congress held in Washington in 1927 and the second held in Leningrad and Moscow in 1930, this third gathering of soil scientists from all countries of the world demonstrates a full realization of the value of effort in common for the betterment of mankind.

Arduous research into the complexities of the soil is recorded in various scientific journals for the benefit of all workers. However there is a distinct value and inspiration, a cementing of common aims and purposes, to be gained in personal contacts, which never can be gained from the printed page. It would be hard to measure the benefit to civilization of these congresses of men who are devoting their lives to a better understanding of the soil, the basis of all life and prosperity.

Without doubt this year's meeting will, if possible, be characterized by even more open minds and spirit of friendliness on the part of the delegates from the different nations, for if the world depression has taught anything, it is interdependence. National welfares are interlocked and national viewpoints have given way to world outlooks. Likewise, more than the agricultural industry is vitally interested in the important problems which will be discussed by these learned men. As science unlocks the doors, cooperation airs the rooms to greater enlightenment and well-being.

Approximately thirty-five prominent American soil scientists, representing the United States Department of Agriculture and fourteen States, make up the delegation which sails from New York on July 20. Included among the States to be represented are New Jersey, Ohio, New York, South Carolina, Connecticut, Illinois, Delaware, California, Massachusetts, North Carolina, Florida, West Virginia, Colorado, and Wisconsin.

To these men, we wish BON VOYAGE. And we want to thank them for all they will give and receive toward the high ideal of advancement for all.

REVIEWS

This section contains a short review of some of the most practical and important bulletins, and lists all recent publications of the United States Department of Agriculture and the State Experiment Stations relating to Fertilizers, Soils, Crops, and Economics. A file of this department of BETTER CROPS WITH PLANT FOOD would provide a complete index covering all publications from these sources on the particular subjects named.

Fertilizers

"Annual Report, State Board of Agriculture 1933-1934," *State Board of Agr., Dover, Del., Quar. Bul. Vol. 24, No. 3, Sep. 30, 1934.*

"Commercial Fertilizers, Commercial Feeds and Agricultural Liming Materials," Univ. of Md., College Park, Md., Control Series, Bul. 152, Aug. 1934.

"Relation of Light, Potassium, and Calcium Deficiencies to Photosynthesis, Protein Synthesis, and Translocation," Agr. Exp. Sta., East Lansing, Mich., Tech. Bul. 141, Dec. 1934, R. P. Hibbard and B. H. Grigsby.

"Registration, Labeling, and Inspection of Commercial Fertilizers; 1934," *Agr. Exp. Sta., Columbia, Mo., Bul. 348, Apr. 1935, F. B. Mumford, L. D. Haigh, and E. W. Cowan.*

"The Effect of a Controlled Nitrogen Supply with Different Temperatures and Photoperiods upon the Development of the Potato Plant," Agr. Exp. Sta., Lincoln, Neb., Res. Bul. 75, Sep. 1934, H. O. Werner.

"The Value of Gypsum as a Supplement to a Concentrated Fertilizer," Agr. Exp. Sta., State College Sta., Raleigh, N. C., Bul. 290, June 1934, L. G. Willis.

"Tobacco Fertilizer Recommendations for 1935," *Agr. Exp. Sta., State College Sta., Raleigh, N. C., Agron. Informa. Cir. 87, Sep. 1934.*

*"Commercial Fertilizers—*1935," *Dept. of Agr. and Mkts., Madison, Wis., Bul. 162, Mar. 1934, W. G. Griem.*

Soils

"Orchard Soil Management," State Fruit Exp. Sta., Mountain Grove, Mo., Bul. 28, June 1934, F. W. Faurot.

"Methods for Determining the Hydrogen-Ion Concentration of Soils," U. S. D. A., Washington, D. C., Cir. 56 (Rev.) Jan. 1935, E. F. Snyder.

"Base Exchange and Related Properties of the Colloids of Soils from the Erosion Experiment Stations," U. S. D. A., Washington, D. C., Tech. Bul. 461, Oct. 1934, C. S. Slater and H. G. Byers.

"Soil Survey of Bay County, Michigan," U. S. D. A., Washington, D. C., Series 1931, *No. 6, C. H. Wonser, J. O. Veatch, L. R. Jones, and L. R. Schoenmann.*

"Soil Survey of Washtenaw County, Michigan," U. S. D. A., Washington, D. C., Series 1930, *No. 21, J. O. Veatch, L. C. Wheeting, and Arnold Bauer.*

"Soil Survey of Alger County, Michigan," U. S. D. A., Washington, D. C., Series 1929, *No. 32, J. O. Veatch, L. R. Schoenmann, F. R. Lesh, and Z. C. Foster.*

"Soil Survey of Houston County, Minnesota," U. S. D. A., Washington, D. C., Series 1929, *No. 31, A. L. Gray, W. J. Moran, A. H. Hasty, Sam Hill, C. H. Mattson, H. C. Newman, and H. T. Petraborg.*

"Soil Survey of Sherman County, Nebraska," U. S. D. A., Washington, D. C., Series 1931, *No. 5, L. A. Brown, R. L. Gemmell, and F. A. Hayes.*

"Soil Survey of Columbia County, Oregon," U. S. D. A., Washington, D. C., Series 1929, *No. 35, W. G. Harper and E. F. Torgerson.*

"Soil Survey of Wyoming County, Pennsylvania," U. S. D. A., Washington, D. C., Series 1929, *No. 34, B. H. Hendrickson, R. T. Avon Burke, K. V. Goodman, and R. L. Smith.*

"Soil Survey of Potter County, Texas," U. S. D. A., Washington, D. C., Series 1929, *No. 33, E. H. Templin and A. E. Shearin.*

"Soil Survey of Rockbridge County, Virginia," U. S. D. A., Washington, D. C., Series 1931, *No. 4, R. C. Jurney, R. E. Devereux, and Edward Shulkcum.*

Crops

The outstanding publication in this section which has come into circulation since our last issue is Miscellaneous Publication No. 200 of the U. S. Department of Agriculture, "Manual of the Grasses of the United States," by A. S. Hitchcock, Principal Botanist, Division of Plant Exploration and Introduction, Bureau of Plant Industry. This is a good-sized volume of 1040 pages, bound in

buckram, and priced at $1.75. To say the least, it is a veritable encyclopedia of the grasses to be found in this country. Its importance can be gauged by the introductory paragraph: "Of all the plants of the earth the grasses are of the greatest use to the human race. To the grasses belong the cereals, sugarcane, sorghum, and the bamboos; and, since they furnish the bulk of the forage for domestic animals, the grasses are also the basis of animal industry."

"The Black Locust in Alabama," Agr. Exp. Sta., Auburn, Ala., Cir. 73, Mar. 1935, L. M. Ware.

"Agricultural Research in Arizona—Forty-fifth Annual Report for the Year Ended June 30, 1934," Agr. Exp. Sta., Tucson, Ariz., P. S. Burgess.

"Vetches and Related Crops for Forage," Agr. Exp. Sta., Berkeley, Calif., Cir. 336, Nov. 1934, L. Gordon Goar.

"Report of the Director for the Year Ending October 31, 1934," Agr. Exp. Sta., New Haven, Conn., Bul. 336, Jan. 1935, William L. Slate.

"Report of the Director for the Year Ending June 30, 1934," Conn. State College, Storrs, Conn., Bul. 199, Sep. 1934, William L. Slate.

"Twenty-third Biennial Report of the Department of Agriculture From July 1, 1932, to June 30, 1934," Dept. of Agr. Tallahassee, Fla., Nathan Mayo.

"Bramble Fruits—Raspberries, Blackberries, Dewberries—How to Grow in Illinois," Agr. Exp. Sta., Urbana, Ill. Cir. 427, Jan. 1935, A. S. Colby, H. W. Anderson, and W. P. Flint.

"Report of the Director for the Year Ending June 30, 1934," Agr. Exp. Sta., Lafayette, Ind., J. H. Skinner and H. J. Reed.

"Agricultural Extension Work in Indiana, July 1, 1933, to June 30, 1934—Report of the Director," Agr. Exp. Sta., Lafayette, Ind., J. H. Skinner and T. A. Coleman.

"Louisiana Copenhagen Cabbage—Methods of Breeding and Description," Agr. Exp. Sta., Baton Rouge, La., Bul. 260, Nov. 1934, Julian C. Miller.

"Summary Report of Progress, 1934," Agr. Exp. Sta., Orono, Me., Bul. 377, Dec. 1934.

"Annual Report of Maine Extension Service Year Ending June 30, 1934," Agr. Exp. Sta., Orono, Me., Bul. 213, Dec. 1934.

"Seed Inspection," Agr. Exp. Sta., Amherst, Mass., Control Series, Bul. 77, Feb. 1935, F. A. McLaughlin.

"Killing Weeds with Chemicals," Mass. State College, Amherst, Mass., Ext. Leaf. 78 (Rev.), Jan. 1934, Orton L. Clark.

"Agricultural Experiment Station Report—Two Years Ended June 30, 1934," Mich. State College, East Lansing, Mich., V. R. Gardner.

"Report of the Proceedings of the Seventeenth Annual Convention of the Michigan Muck Farmers Ass'n.," Mich. State College, East Lansing, Mich., Paul M. Harmer, Sec'y-Treas.

"Crop Mixture Trials in Michigan," Agr. Exp. Sta., East Lansing, Mich., Spec. Bul. 256, Dec. 1934, R. H. Morrish.

"The Quarterly Bulletin," Agr. Exp. Sta., East Lansing, Mich., Vol. 17, No. 3, Feb. 1935.

"Forty-eighth Annual Report of the Agricultural Experiment Station of Nebraska," Agr. Exp. Sta., Lincoln, Neb., Feb. 1, 1935, W. W. Burr.

"Annual Fodder and Silage Crops for Nebraska," Agr. Exp. Sta., Lincoln, Neb., Cir. 52, Mar. 1935, W. E. Lyness and T. A. Kiesselbach.

"Cultural Practices in Corn Production," Agr. Exp. Sta., Lincoln, Neb., Bul. 293, Jan. 1935, T. A. Kiesselbach, Arthur Anderson, and W. E. Lyness.

"Wilt and Cold Resistance of Self-Fertilized Lines of Alfalfa," Agr. Exp. Sta., Lincoln, Neb., Res. Bul. 76, Sep. 1934, George L. Peltier and H. M. Tysdal.

"Annual Report of the Board of Control for the Fiscal Year Ending June 30, 1934," Agr. Exp. Sta. Reno, Nev.

"Forty-seventh Annual Report, 1934," New York State College of Agriculture and Cornell University Agricultural Experiment Station, Ithaca, N. Y.

"Report of the North Carolina Department of Agriculture, from July 1, 1932, to June 30, 1934," Dept. of Agr. Raleigh, N. C., Wm. A. Graham.

"The Culture and Handling of the Blakemore Strawberry," Dept. of Agr., Raleigh, N. C., The Bulletin, Nov. 1934, G. M. Darrow and Charles Dearing.

"The Bimonthly Bulletin," Agr. Exp. Sta., Wooster, Ohio, Vol. 20, No. 173, March-April 1935.

"Applying Science to Agriculture—Report of Oklahoma A. & M. College Agricultural Experiment Station July 1 1932, to June 30, 1934," Agr. Exp. Sta., Stillwater, Okla., C. P. Blackwell.

"Studies with Alfalfa Hay for Milk Production," Agr. Exp. Sta., Corvallis, Ore., Sta. Bul. 328, June 1934, I. R. Jones, P. M. Brandt, and J. R. Haag.

"The Tung Oil Tree in Texas," Agr. Exp. Sta., College Sta., Tex., Cir. 75, Mar. 1935, P. R. Johnson and S. H. Yarnell.

"Good Gardening in Vermont," Agr. Exp. Sta., Burlington, Vt., Ext. Cir. 82, Apr. 1935, Mrs. C. P. Brooks, P. R. Miller, and M. B. Cummings.

"Department of Agriculture—Immigration of Virginia," Richmond, Va., Bul. 326, May 1935.

"Home Gardens," Agr. Exp. Sta., Pullman, Wash., Ext. Bul. 202, Mar. 1935, J. C. Snyder.

"Potato Growing in Wisconsin," Agr. Exp. Sta., Madison, Wis., Ext. Cir. 273, Jan. 1935, J. G. Milward and J. W. Brann.

"Pea Diseases and Their Control," U. S. D. A., Washington, D. C. Farmers' Bul. 1735, Nov. 1934, L. L. Harter, W. J. Zaumeyer, and B. L. Wade.

"Why Red Clover Fails," U. S. D. A., Washington, D. C., Leaf. No. 110, Nov. 1934, E. A. Hollowell.

"Influence of Spacing and Time of Planting on the Yield and Size of the Porto Rico Sweetpotato," U. S. D. A., Washington, D. C., Cir. 327, Nov. 1934, J. H. Beattie, Victor R. Boswell, and E. E. Hall.

"Agricultural Investigations at the Belle Fourche (S. Dak.) Field Station, 1926-32," U. S. D. A., Washington, D. C., Tech. Bul. 454, Oct. 1934, Beyer Aune, L. A. Hurst, and Albert Osenbrug.

"Seasonal Variations in Carrying Capacity of Pastures for Dairy Cows in Milk," U. S. D. A., Washington, D. C., Tech. Bul. 465, Dec. 1934, T. E. Woodward and R. R. Graves.

"Cotton and Cottonseed," U. S. D. A. Washington, D. C., Misc. Pub. 203, Nov. 1934, Rachel P. Lane and Emily L. Day.

Economics

While primarily based on income from a dairy herd, Wisconsin College of Agriculture's Bulletin 429, "Managing the Farm for Better Income," contains practical discussions for farmers in other sections of the country. The authors, P. E. McCall and I. F. Hall, have divided their discussion of the findings from research into six general headings:

1. 60 to 80 acres may be enough,
2. Diversification adds income,
3. High production per cow needed,
4. Efficient feeding necessary,
5. Good crop yields important,
6. More land in alfalfa pays.

The presentation is concise, practical, and interesting.

"Economic Changes in Montana's Wheat Area," Agr. Exp. Sta., Bozeman, Mont., Bul. 295, Jan. 1935, E. A. Starch.

"Price Movements and Pennsylvania Agriculture," Agr. Exp. Sta., State College, Pa., Bul. 309, Oct. 1934, F. P. Weaver and D. H. Walter.

"A Study of the Costs and Returns from Grading Vegetables," Agr. Exp. Sta., Kingston, R. I., Bul. 249, Jan. 1935, R. B. Corbett.

"Price-Quality Relationships in Farmers' Cotton Markets of Texas," Agr. Exp. Sta., College Sta., Tex., Bul. 501, Dec. 1934, W. E. Paulson and Joel F. Hembree.

"Relative Importance of Intangible Property in Texas," Agr. Exp. Sta., College Sta., Tex., Bul. 505, Feb. 1935, L. P. Gabbard.

"Grade, Staple Length, and Tenderability of Cotton in the United States 1928-29 to 1932-33," U. S. D. A., Washington, D. C., Sta. Bul. 47, Jan. 1935.

Erosion on Small Slopes

Because their cultivated lands are fairly level, many farmers think they are not losing fertile topsoil by sheet erosion during heavy rains and do not need to protect them by terraces or other methods. But much of the land is losing soil. Measurements by engineers of the United States Department of Agriculture at a soil-erosion experiment station near Ardmore, Okla., where land is fairly level, show considerable losses on unterraced and otherwise unprotected areas.

A rain in 1932 at Ardmore of 6.1 inches caused a loss of approximately 11 tons of soil an acre from an unterraced land slope of 1.9 per cent. Comparison of this loss with that of 14.5 tons an acre caused by a 3-inch rain on a slope of 5.1 per cent at the Guthrie, Okla., farm illustrates the seriousness of erosion on land slopes as small as 2 per cent.

U. S. D. A. Clip Sheet

Michigan Grows Good Potatoes

By J. J. Bird

Field Representative, Michigan Crop Improvement Association

FIFTY-NINE 300 Bushel Club members averaging 379 bushels of potatoes per acre can't be wrong. What potato grower is not interested in the methods used to produce 519 bushels per acre in Michigan in 1934? For that matter what grower is not interested in the production methods followed by the 40 or 50 growers producing 300 or more bushels per acre on five or more acres each year? Obtaining this information constitutes the chief reason for the existence of the Michigan 300 Bushel Potato Club, organized in 1922.

The First Two

Alphonse Verschure of Manistique heads the list of 59 members for 1934 with his high yield of 519 bushels of Russet Rurals per acre on 10 acres. These Rurals graded 95 per cent U. S. No. 1 and were of excellent type. Facts of this nature are important since they emphasize the important connection between high yields and high quality, and there is no overproduction of high quality produce. Such yields are not matters of chance since Mr. Verschure has been a consistent producer of 300 bushels or more per acre for many years.

Weather conditions must be favorable for good yields but methods are more important. This is borne out by the fact that the average 1934 yield for Schoolcraft County, where this grower lives was 84 bushels per acre. Something would be wrong if Mr. Verschure failed to get a high yield of excellent potatoes when he fall plowed a clover sod, dragged and disked it 12 times, row-cultivated only twice, applied 2,000 pounds of commercial fertilizer per acre, planted 30 bushels of certified seed per acre, and sprayed with Bordeaux mixture six times. This schedule of production may appear extreme to many growers, but with the exception of the amount of commercial fertilizer used, it will not appear extreme when compared with the methods followed by the average 300 Bushel Club member.

Roy Eagle of Sault Ste. Marie took second honors with his yield of 502 bushels of Green Mountains per acre. He fall plowed a mixed hay sod, dragged and disked 12 times, row-cultivated twice, applied 400 pounds of a 4-16-16 commercial fertilizer besides seven loads of manure per acre, planted 20 bushels of seed per acre, and sprayed seven times.

Comparison

The recent interest in Green Mountain growing in Marquette, Baraga, and Houghton counties has greatly increased the number of yields over 300 bushels per acre in the Upper Peninsula during the last five years. Thirty-six members of the present Club live in the Upper Peninsula representing 12 counties and had an average production of 388 bushels per acre. The 23 members in the Lower

Peninsula representing nine counties averaged 365 bushels per acre. The Club average yield of 379 bushels per acre was 240 bushels above the average yield of the 21 counties represented by the 1934 Club members.

Varieties

The varieties represented include the Russet Rural, White Rural, Green Mountains, and Katahdin. In the Upper Peninsula 23 members grew Green Mountains, 11 grew Russet Rurals, and two grew White Rurals. Russet Rurals predominated in the Lower Peninsula, 22 growing this variety, one growing the White Rural, one Early Minnesota, one Katahdin, and three a combination of Russet Rural and Katahdin. The new variety Katahdin, recently released to Michigan growers through the Michigan State College, produced yields equal to the Rurals, but in most cases the acreage was below the five-acre requirement for the Club. Yields of 450 and 465 bushels per acre were reported by two Club members in the Lower Peninsula.

The effectiveness of certified seed production practices was emphasized by the fact that 57 of the 59 members were growers of certified seed potatoes. The Upper Peninsula group was the most consistent in the use of commercial fertilizer, in reducing the number of row-cultivations, and in the number of sprays applied. The following data on production methods practiced by the 59 Club members of 1934 are significant:

Tillage

Probably the widest departure from the methods used by the average Michigan potato grower is found in the tillage operations. The potato plant produces a large number of roots near the surface of the soil which may be easily injured by the ordinary row-cultivation. Being a plant of large leaf area it consequently suffers seriously from root pruning. It is evident that the leading potato growers as represented by the 300 Bushel Club members try to do most of the cultivation before the plants are six inches high rather than after.

Since the organization of the Club in 1922 the number of soil-fitting and weed-control operations with the drag and disk has been gradually increasing and the number of row-cultivations decreasing until at present the drag or disk is used on an average 7.3 times and the row-cultivator is used twice, the latter being the lowest average number of row cultivations recorded for the Club to date. This, compared with the average grower's figure of five times for the row-cultivator, is worth considering. One grower in the Upper Peninsula did not row-cultivate at all and 12 row-cultivated only once. Since practically all of the Club members each year are certified potato growers, it goes without further mention that the fields represented were practically free from grass and weeds as required for certification. Weed control was effected by the use of the drag two or three times after planting and followed by the weeder once a week where possible until the plants were over half grown. Club members are rapidly coming to make more use of the weeder.

Quack Grass

Alfalfa sod was plowed for potatoes by 70 per cent of the Lower Peninsula members. In the Upper Peninsula alfalfa is becoming established in the potato rotation. Quite a bit of new land is still being broken up for potatoes in that region.

Quack grass has apparently ceased to be a menace. In fact it would appear to be a fairly good green manure crop for potatoes since eight of the 36 members in the Upper Peninsula plowed a quack sod in the fall or summer of 1933 for their 1934 crop. The fourth highest yield was produced on a quack grass sod dragged 22 times and required only three row cultivations. An average of 8.4 draggings and 2.3 row-cultivations were

given the quack grass fields.

Fall plowing was favored by 75 per cent of the members. Only four spring plowed in the Upper Peninsula where the season is shorter than farther south. Those not fall plowing made a practice of early spring plowing about May 1. Sixteen plowed twice.

Planting

With the exception of two, all growers qualifying for Club membership planted certified seed. In the matter of amount of seed planted per acre there is a wide departure from the State average of approximately 11 bushels to the present Club average of 22 bushels per acre. One member planted 35 bushels and said that it was his best investment. Five planted 30 or more bushels per acre, following their regular practice.

The leading growers plant early enough to mature the variety they grow. In the Upper Peninsula 60 per cent planted before May 30 and in the Lower Peninsula 50 per cent planted before June 15. All seed was planted the day it was cut.

Fertilizer

Drought seasons do not discourage the 300 Bushel Club members from using commercial fertilizer. Besides an average application of 8.7 loads of manure per acre, an average of 456 pounds of high analysis commercial fertilizer was applied, 4-16-8, 3-12-12, 2-12-6, and 2-16-8 being the most popular analyses. In practically all cases commercial fertilizer was applied in the row at planting time.

Spacing

Close spacing of plants in the row has come to be a standard practice with the 300 Bushel Club members. Spacing as close as 9 to 12 inches in the row is common. Eighty per cent spaced plants 15 inches or closer in the row, with row spacing varying from 28 to 36 inches. Club members have found that close spacing of plants under good cultural conditions not only increases yield but reduces hollow heart, usually a serious defect in Russet Rurals in seasons of late rainfall. The twice normal rainfall in September of 1934 resulted in 30 per cent hollow heart in many check rained fields. The 300 Bushel Club members had less than five per cent hollow heart in their potatoes.

Spraying

Less than 10 per cent of Michigan potato growers do a good job of spraying. All growers in the 1934 Club used high-pressure sprayers and made on an average 5.1 spray applications of Bordeaux mixture. Nine sprayed seven or more times. All spray machines used were equipped with three nozzles per row and developed approximately 200 pounds pressure. In all cases Bordeaux mixture was home-mixed, and the standard formula of eight pounds of copper sulphate and twelve pounds of chemical hydrated lime was used. Calcium arsenate for chewing insects such as the common potato bug was rarely used over twice. Nineteen growers controlled the potato bug with one application of calcium arsenate. Beginning the spraying schedule early when the plants were from four to six inches high was the secret of bug control with these growers.

Awards

Each grower qualifying for membership in the Michigan 300 Bushel Potato Club is presented with a medal in the form of a miniature approved type Rural potato in gold, silver, or bronze. Those producing 400 or more bushels per acre receive the gold medal; those producing 350 to 400 bushels receive the silver medal; and those producing from 300 to 350 bushels receive the bronze medal. These awards are made at the time of the Crop Improvement Association Banquet during Farmers' Week.

Disease Resistant Varieties of Crops

By Dr. E. N. Bressman

Oregon Agricultural College

THERE is striking evidence that varieties of certain plants are able to withstand attacks of diseases like smut, rust, mildew, and wilts of various sorts, while other varieties are readily susceptible. The reason why certain varieties are resistant and others susceptible affords an extremely complicated study but progress, in finding out just what disease resistance is, has been made in several places.

Resistance may be due to several things. It may be due to the structure of the plant, both internal and external structure. It may be due to a heritable factor. Ordinarily this factor may be transferred and the plant breeder bases much of his work on the ability to transfer disease resistance from one variety to another. A third explanation of resistance is based on the physiological action within a plant. This may be due to the development of the tannin content of a plant, its acidity, its osmotic pressure and similar factors.

Time of Planting

Other escapes may be due to the fact that the plant is so early that it is harvested before the disease develops. Later varieties may be readily attacked. Many commercially important varieties have this factor of either earliness or lateness which help them to resist disease.

There are many peculiar external types of growth about plants which help them to fight off disease. For example, we have some varieties which have extremely hairy leaves; others have waxy leaves; others have thick leaves; etc. One of the most recent contributions to the resistance of wheat varieties to rust attributes this faculty to the small stomata in certain varieties. These small breathing pores in some cases keep out spores of fungi or disease which must enter through them. In other cases, the time of stomata opening appears to be of importance, according to recent work. This type of resistance is not only important from the plant-disease standpoint, but also from the standpoint of insect damage. Hairiness of the leaves may stop aphids. Various colors of leaves and parts of the plant also may have an effect upon their attraction or repelling action on various parasites.

Internal Structure

In some cases plants resist disease by means of some internal structure. The disease enters the plant but there appears to be an antagonism set up and the plant overcomes the disease organism. This may be due to the release of acids or poisonous substances through the action of enzymes. Recent work in Canada has shown that this may be an important factor in warding off black stem rust of wheat. With stinking smut or bunt, which has done so much damage to our wheat crop, it is thought by some

workers that the organism enters all varieties and is overcome by some internal condition in those that are resistant.

The environment appears to have a great effect upon a plant's ability to remain healthy. Under some conditions of temperature and moisture the plant is very susceptible while under other conditions it is resistant.

Fertilizers Important

Fertilizers appear to play an important role. Potash has long been credited with building up a resistance to disease in plants, and there are many examples where this important element not only affects yields but reduces disease. Under some conditions plants develop considerable crude fiber and this stops some organisms from tearing down the plants. In many cases seedlings are susceptible to disease while the mature plants are resistant.

In the development of disease-resistant varieties, perhaps as much work has been done with black stem rust of wheat as with any other single organism and plant. Many outstanding varieties have been developed, but the situation is somewhat complicated by forms of the disease which differ in their ability to attack varieties. In other words, varieties are resistant to some forms of the disease and not to others. Inasmuch as there are about 100 known forms, one can readily see that the problem is no easy one. It is fortunate, however, that certain varieties are resistant to large groups of these forms, and so the possibilities of combining resistance to all forms in one variety is still great. Varieties of various crops to resistant leaf rust, crown rust, and many of the other types of rusts, including rust on ornamentals such as snapdragons, have been found.

It is very difficult to name high yielding varieties of a crop which are entirely resistant to all forms of any one disease and under all environmental conditions. There are many so-called resistant varieties, however, which are superior to most other varieties of the same crop. Several of these are mentioned below. They are not only of value to the grower but also to the breeder who is interested in further development of disease-resistant varieties.

Kanred is a winter wheat resistant to many forms of leaf rust. Hope, Ceres, and Marquillo are spring wheats resistant to many forms of black stem rust. Tenmarq wheat is resistant to Hessian fly and leaf rust. Missouri winter wheat No. W 529 and Trumbull from Ohio are resistant to loose smut.

A large number of bunt-resistant varieties of wheat have been developed. Practically all of them are resistant to only some of the forms of this disease. These new varieties include Ridit, Albit, Oro, Ashkof, Minard, Nabob, and Berkeley Rock.

Iogold is a stem-rust resistant oat variety. Victoria and Anthony are resistant to many forms of crown rust of oats.

Markton is a pure line selection of oats developed at the Moro, Oregon, Experiment Station. It is very resistant to covered smut of oats. Ohio No. 201 is resistant to loose smut.

Several new disease-resistant flax varieties have been developed. Buda is resistant to flax wilt and Bison to both rust and wilt.

Other Varieties

Hardistan alfalfa is resistant to alfalfa wilt. Tennessee Anthracnose-resistant Red Clover, as its name implies, is resistant to a dreaded disease. Hungarian vetch is resistant to aphis attack.

Alcross and Horol, two varieties of canning peas developed in Wisconsin, are claimed to be strongly resistant to wilt.

There are even some potato varieties immune to some of the baffling virus diseases. Both the Irish Cobbler and the new Katahdin are resistant to mild mosaic.

The total list of such varieties resistant to various diseases runs into hundreds of names. In addition to the above examples, one can find the Iron variety of cowpeas, resistant to both wilt and root knot; Columbia, Marvel, and Norton tomatoes, resistant to wilt; Iocope cabbage to yellows; Estella, Orel, and Kiefer pears to fire-blight; Robust beans resistant to anthracnose, and numerous others.

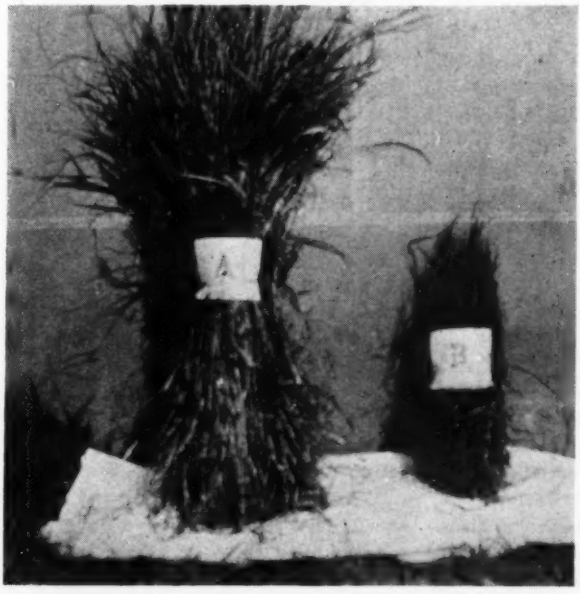
Reed Canary Grass Demands Plant Food

by H. L. Harris

Publicity Specialist, Minnesota Agricultural Experiment Station

REED Canary grass, limelighted into popularity during the last few years by the Minnesota Agricultural Experiment Station, is proving a valuable crop for peat bogs and other low-lying areas too wet for other hay or grain crops. Like any other plant, however, Reed Canary grass demands plant food, a fact repeatedly stressed by the University soils specialists and the county agents who have played a big part in introducing this crop to farmers.

In 1934, Agent A. R. Rollin of Aitkin County and George H. Nesom, University soils specialist, conducted a demonstration on the farm of Fred Mackaman of Aitkin to show the result of applying phosphate and potash to a high-lime peat bog. On a part of this bog, 300 pounds per acre of 0-9-27 fertilizer was applied. The remainder of the bog received no fertilizer. The fertilized bog produced 2.12 tons of Reed Canary grass hay per acre; the unfertilized part only six-tenths of a ton, showing very conclusively that adding phosphate and potash fertilizer to high-lime peat bogs is very necessary and worth while.



Reed Canary grass yields on a high-lime peat.

Left — **Yield from 300 lbs. per acre of 0-9-27 fertilizer.**

Right — **Yield from similar plot with no fertilizer.**

Conn. Valley Soils Need Potash

(*From page 9*)

Comparing the treatments, we find that when used alone, superphosphate and potash give a total increase of 2117 pounds of hay, but when used conjointly the resulting increase was 3337 pounds. All differences are, of course, figured from the check plot yields.

The response for alsike clover is even more striking, total increases for the two elements being 694 pounds while their conjoint use totaled 2922 pounds.

It appears that superphosphate gave a slightly better account of itself upon red and alsike clover than it had on the preceding crops on these plots. It may be recalled that all the chemicals were applied by top-dressing, annually. As superphosphate is largely fixed in the surface layers and hence does not reach to any extent the feeding area of hay roots, it seems that plowing and working the soil immediately preceding the red and alsike clover crops served to mix these previous applications of superphosphate deeper into the soil, and that natural agencies rendered them more available to the clovers that were grown than they had been to the crops for which they were applied.

On these two pure stands of clover, nitrogen actually appeared to depress the yield, even where used with phosphoric acid and potash; the effect of manure applied four years earlier had almost entirely disappeared, and lime gave a very disappointing account of itself. These results only serve to emphasize the importance of potash on these Connecticut Valley soils, and superphosphate, too, where it can be made to penetrate the area of the feeding roots.

The results for the clovers on this terrace were very disappointing, in our opinion, in view of the sweet clover and alfalfa sods that had been utilized, except where phosphorus and potash had been applied. The land therefore was plowed following the first harvest of the clovers and given a uniform application of 10 tons of manure per acre, to more closely approximate farm practice, and seeded to winter wheat in the autumn of 1933. The wheat was used as a nurse crop for red and alsike clover broadcast in March 1934, these crops being switched in their former locations in the field. The plots were again top-dressed according to schedule.

The winter of 1933-34 was very severe in New Hampshire, and some winter-killing was noted on the wheat.

Black Locusts Will Anchor Sand

(*From page 22*)

ever, even coarse sand particles were moved long distances by saltation or a sort of jumping movement. Thus were the horse tracks of a road filled level full during these days. And in this very manner has the wind covered several acres of highly productive brown loam and sandy loam with coarse sand. Once covered with from 10 to 20 inches of such coarse material, good productive soils are forever lost from ordinary cultivation.

Obviously the economical procedure is to plant black locusts on blowing sands and thus anchor it now. Doing so will conserve for future use productive soils situated adjacent to dune sands.

The crop was harvested, however, and weighed as hay.

The average response for the various substances used on the wheat plots for both areas combined, expressed as increases in hay per acre, is here summarized.

Lime	— 240	pounds
Nitrogen	— 197	"
Phosphorus	—1565	"
Potash	—1686	"

Here again it must be remembered that there must have been much residual effect from the superphosphate and potash applied during previous years, but the data appear to be conclusive that potash is most essential even where manure has been applied, and that superphosphate stimulates yields particularly if it can be so applied as to come into contact with the feeding roots.

This summarizes in a brief manner the results of five years' work with fertilizers and lime on hay crops on one of the terraces of the Connecticut River near Claremont, New Hampshire. We feel that the need for frequent plowing so as to introduce fresh quantities of superphosphate into the soil is emphasized. Lime for alfalfa and sweet clover is indicated but is not yet so necessary for crops having a lower lime requirement. Nitrogen is important where grass alone is considered. But none of these substances can do their best without fresh increments of available potash, which, on this particular soil, appears to be the element most likely to limit the growth of the forage crops with which we have been working. We have not tried tests on all the crops in the category of Connecticut Valley farmers, but we begin to have strong suspicions as to what the results might be if we did.

Crop of Timothy Seed Seems Certain Profit

A farmer in writing to the United States Department of Agriculture asked for an opinion as to whether his profits will be greater from a crop of timothy hay or a crop of timothy seed.

Dr. Adrian J. Pieters, of the Forage Crops Division says that while no one can see into the future, timothy seed is almost certain to have a sure, high cash value. This spring there was an estimated shortage of about 33,000,000 pounds. Supplies of neither timothy hay nor timothy seed are equal to the demand.

Other hays, especially annual plants such as Sudan grass and soybeans, may appear in quantities this year if conditions are favorable, and can substitute for timothy. But there is no way to make up the shortage of timothy seed, except with timothy seed—grown in this country. Imported seed is not so well adapted to conditions here as that grown in this country. Most of it comes from the northern European countries where the days are longer and the nights shorter than in most of the timothy States.

The farmer who decides to harvest his timothy as seed still has a lot of valuable feed left in the timothy straw remaining. That is another reason why Dr. Pieters favors harvesting a crop of timothy seed this year, rather than as hay, other conditions being equal.

The Inquiring Mind *and the* Seeing Eye

(*From page* 12)

found to be as much as 6° or 8° and occasionally as high as 12° at the time of minimum temperature in the early morning. This study was continued later by the U. S. Weather Bureau and Professor Whitson's conclusions were corroborated.

Confirmed Exhaustion Theory

Studies in 1905 and 1906 disclosed that nearly one-third of the nitrogen and organic matter and more than one-third of the phosphorus originally present in the virgin soils of Wisconsin, that to date had been cropped for about 50 years, had been exhausted. This supported Dean W. A. Henry's contention that a change to livestock production and especially dairying, would be of the utmost importance to Wisconsin agriculture. From 1906 on, Professor Whitson studied the conditions affecting the availability of phosphorus to growing crops. He found that acidity of the soil greatly reduced the availability of phosphates, by forming iron phosphates which are much less available than those of calcium. This work was continued with Professor Stoddard, and the results were published in Wisconsin Research Bulletin No. 2 in 1909. It has been followed up by Professor Truog during the past 16-18 years.

In 1903, Dean Henry asked Professor Whitson to make a study of conditions in the northern part of the state. This study was made and led to the establishment of experimental fields at Superior, Iron River, and Ashland, which later resulted in the establishment of the sub-stations at Ashland, Spooner, Marshfield, and Sturgeon Bay.

The study of land drainage conditions and their influence on productivity begun in 1904, with the assistance later of Professor E. R. Jones, proved that it was practicable to under-drain the heavy red clays of the Lake Superior region. During this period field studies on the improvement of marsh, sandy, and heavy clay soils were undertaken at Mather, Sparta, Marinette, and other points in Wisconsin. The work at Sparta led to the establishment of a sub-station at Hancock. A comprehensive study of soil acidity and liming was undertaken about 1911 with the assistance of W. W. Weir.

State Soils Laboratory

In 1913, an annual appropriation of $5,000 was provided by the Legislature partially to defray the expenses of field examinations of farms and laboratory analyses of soils, under the direction of Professor Whitson. This work led to the establishment of the State Soils Laboratory and the extension work in soils now being conducted by the Agricultural Department, which work had been developed on a high standard by Professor C. J. Chapman.

The field work drew Professor Whitson's attention to the necessity of controlling losses of soil erosion and at that time, about 20 years ago, recommendations he suggested were strip farming, increased grass and hay crops on steep lands, and the putting in of dams for filling gullies as means of combating the trouble.

As an outcome of these studies the Director of the Geological and Natural History Survey, which had already made a very general map of the soils of a portion of north-central Wisconsin from data collected in con-

nection with the geological survey, asked Professor Whitson to take charge of a new soil survey division. Largely through the interest of the late ex-Governor W. D. Hoard, the Legislature of 1909 made an appropriation for this undertaking and a detailed survey of the soils of the state was begun in cooperation with the Federal Bureau of Soils. This work has continued and has resulted in the publication of soil maps and reports on nearly all the counties of the southern half of Wisconsin, and of general or reconnaissance maps of the northern half.

Trainer of Experts

In 1926, a comprehensive report on the soils of the state was written by Professor Whitson and published as Bulletin No. 68 of the Geological and Natural History Survey. A most important result of this soil survey work has been the development and training of young men as experts in that line of service. Among these may be mentioned Jos. A. Chucka, Guy M. Conrey, T. J. Dunnewald, Oscar Magistad, A. H. Meyer, W. H. Pierre, Geo. D. Scarseth, L. R. Schoenmann, H. L. Walster, and W. W. Weir.

The study of the soil, through survey work, later drew the attention of Professor Whitson to its connection with the development of forestry. While forest growth is dependent on the soils in a complex way, it became apparent that the relation of forest growth to soils must be approached from an angle quite different than that of the relation of agricultural crops to soils. As the outcome of this matter Dr. S. A. Wilde, who recently came to this country after several years study of forest soil work in Central Europe, is now undertaking a comprehensive study of the forest soils of the northern half of Wisconsin.

The soil maps and reports prepared by Professor Whitson and his associates have been extensively used by people interested in many lines, including actual farmers, teachers of agriculture, tax and highway commissioners, loaning agencies, and especially by experts engaged in the recent appraisal work of the Federal Loan Bank, and in connection with erosion control and forest and land zoning.

In this useful way, throughout the long years of his service, Professor Whitson has kept himself interested, busy, and useful, and has also found time for much instructional teaching which he began as assistant to Professor King. His early work with the Short Course in land drainage, gasoline and steam engine operation, use of small feed grinders, and various other subjects led eventually to the establishment of the present Department of Agricultural Engineering. He also taught Long Course students, saw the class in soils grow to over 140 members and gradually exceed that number, and had the satisfaction of knowing that work in that course developed a number of outstanding men in the instructional work in Soils, including Dr. H. L. Walster, now Dean of the North Dakota College of Agriculture, Dr. Guy Conrey of the Ohio State University, and Professors E. J. Graul and Emil Truog of the Wisconsin College of Agriculture.

An Able Writer

Professor Whitson's writings on his specialties have been voluminous and of great practical value. They include his notable treatise on the "Soils of Wisconsin" published in 1926; "Notes on Soils" in 1910; and in 1912 "Soils and Soil Fertility" (with Dr. H. L. Walster). In his publications he tells us that it is the object of the soils survey to make an inventory of the soils of the state and to be a practical help to farmers in locating and describing the different soils, by determining their physical character and chemical compositions, and by offering suggestions for their management. In this useful work chemical analyses of the soils

are also made to determine the amounts of various essential plant-food elements which are present. Such analyses show whether the soils contain a large store of plant food or only a small quantity, and indicate which kinds of plant food will probably be needed first. The amounts of organic matter in the soils are determined, and tests are made to show conditions relative to soil acidity.

One of these analyses showed that sediment washed from a side hill contained nearly three times as large a percentage of nitrogen and more than twice as much phosphorus as did the soil from which it had been removed. The erosion work now being done by Professors Whitson, E. R. Jones, and other assistants and engineers in Wisconsin is being undertaken to stop such losses, save many farms from utter ruin, and turn science to the practical aid of the farmer.

That, always, has been the chief object of Professor Whitson's life work and we wish him many more years of useful service, extend him the thanks of those he has benefited by his labors, and trust he will be blessed with good health and happiness in the remaining years of his life.

Micro-chemical Methods

(*From page* 17)

lime recommendations for crops that require an acid soil. For example, aluminum solubility is associated with the soil reaction and organic matter content of the soil. If a soil gives a test for aluminum in the soil extract, the soil should be limed or the organic matter content increased, or planted to a crop more tolerant to soluble aluminum. The above examples serve to show some of the instances in which the soil tests have aided in soil fertility problems. These no doubt will be extended when more information and better methods have been developed. The short chemical methods have possibly their greatest application in diagnosing the failure of some soils to grow crops. For example, one often sees spots in fields or parts of a field that fail to produce. A comparison of the analyses of the soil from both the productive and unproductive areas often reveals the source of the trouble. After the trouble has been corrected, the crops grow equally as well on all parts of the field.

The grower has long looked to the chemist for help in solving some of his problems. He has felt that there must be some way that his soil and crop needs could be diagnosed without actual experience in the field, which is both time-consuming and expensive. While too much must not be expected from a soil diagnosis, some insight to the soil fertility can be gained. The grower's response to this type of service is tremendous. In general, he is likely to be so well pleased with the results that a test of every field is wanted before the crop is planted and often several times after the crop has been planted for additional fertilization.

It is believed that the available methods are best used by one versed in chemistry and quite familiar with soils and the special requirements of the different types of plants. This person should, by all means, be familiar with the individual or the community fertility problems. As the occasion and demand arise, these experienced and technically trained persons, who understand the scientific principles underlying the common field procedures and who also are in touch with the problems of the farmers, may train and send out men to perform this service.

Sod Dams Save Soil

By A. A. Jeffrey

Editor, Missouri College of Agriculture, Columbia, Missouri

BLUEGRASS sod, cut into six-inch squares and placed in old fertilizer bags, has proved the cheapest and most effective material for building small barriers to check incipient gullies in the wheat fields and meadows of J. O. Erhart in Cole county, Missouri. In seven years of continuous use this method has given such good results that it is spreading among Mr. Erhart's neighbors and is now recommended by his State College of Agriculture throughout the State.

The work can be done at any time in the year when the beginnings of gullies make their appearance, as well as at wheat seeding time, when barriers are placed in the natural draws and depressions that invite erosion of the newly worked soil. Bluegrass sod from fence-rows adjacent to the field is spaded up in pieces about the width of the spade and half as thick. These are tumbled loosely into empty fertilizer sacks—or other burlap bags—and each sack, when one-third to one-half filled, is securely tied at the top.

These sacks of bluegrass sods are then carried to the draws or gullies and flattened out to form small barriers or dams. In many places one sack will do the trick, in others two or three are used, each being tramped down snugly to fit the contour of the ground. The coarse burlap holds the sod in place but does not prevent the bluegrass from growing through the upper sides or from sending its roots down through the lower.

Mr. Erhart, the originator of this method, points out that there is always enough fertilizer adhering to the sacks to give the bluegrass a good vigorous push and that this same remnant of fertilizer would soon rot the sacks and make it useless if saved for other pur-

J. O. Erhart and his son with the type of sod barrier used on their Missouri farm.

In one year the rank growth of bluegrass, indicated by the dark color, has healed this wash.

poses. By the time the sacks have rotted away, when used for barriers, the bluegrass sod has established itself.

In case a wash is too wide for one sack to reach completely across it, two or more sacks may be placed end to end, says Mr. Erhart, care being taken to make the dam lowest at its center so that water will not cut around.

The same method is applied by Mr. Erhart to his meadows, the year following wheat seeding. If washes start, he promptly places a few bluegrass barriers where they will do the most good. He has kept gully erosion in control and has succeeded in building up the fertility and contour of fields that were thin and badly washed when he bought the farm 19 years ago.

The Humus Front

(*From page* 21)

the orchardists. On the truck farm not less than six weeks is needed to grow the humus crop. A valuable crop of vegetables can be grown in the same time, and growers are reluctant to give up the use of the land to a fertilizer crop. However, the Rhode Island station found that the returns from a rotation of vegetables were greater when a green manure crop was included than without it. Three crops were grown in a season without the green manure, and only two with it. The value of the humus to the other crops was sufficient to more than overcome the handicap of a loss of one crop in the rotation to the green manure.

On the general farm more legumes should be grown, as no other class of crops renews humus as effectively as the legumes. Legumes are valuable cash crops when grown for seed, and legume pastures and hays are superior to non-legumes. Any crop which follows a legume yields more because of the supply of rich humus left in the soil.

The English are investigating a field method for making humus of farm wastes. Where grain is harvested by combine, the straw is left on the soil. Results of a two-year trial in England indicate that the straw may be worked into the soil directly and allowed to rot in place. They recommend adding 150 pounds of ammonium sulfate for each ton of straw, the fertilizer being spread on the soil and worked in with the straw. The sulfate of ammonia (any nitrogen fertilizer will do) is to cause the straw to humify readily. Straw treated in this way, and supplemented with phosphate and potash equivalent to that in stable manure, has given as big crop increases as farm manure. Much straw might be utilized in this or other ways to make humus instead of burning or allowing it to rot in piles.

There is no conflict between fertilizer producers and those who promote humus renewal. When the hu-

mus is burned out, commercial fertilizer becomes less effective. Then the farmer says to the fertilizer people, "Your fertilizers have lost their potency. Give us something to put the 'old pep' back into our soils." The elusive "something" that is needed is humus. With adequate humus renewal, fertilizers may be safely used in larger amounts and with greater assurance of returns.

Today Europeans, and especially the Germans, are concentrating upon a program for healthy humus economy. The German slogan is a planned humus economy to assure "German nutrition for the German people from the German soil." Their alert soil scientists know the key to soil fertility. German farmers use more commercial fertilizers than we, and they will no doubt continue to use more. Their crop yields average larger than ours. Yet their scientists are not satisfied but have sought out the weak link in their system. The result is a nation-wide organized effort to bring the importance of humus renewal to the attention of their people. We, in this country, have a similar humus problem before us, and the time has come to give it serious attention.

Science Plus

(*From page 6*)

could stay right at home and fight to a finish.

As we talk "parity" so often these days, why not liken the number of county agents in service at a few important periods to the well-known index put out by the B. A. E. in Washington? The data were obtained direct from the clerical staff of Mr. Warburton.

As the base period of 100, we take 1918, the feverish War era. At that time county agents, because of their numbers compared with "pre-war" times, had the greatest "purchasing power"—for Fords and sundry. At the base period there were 2,435 county agents. We now index back to 1914, when there were 928 county agents, and the index is 38. Not much if any "purchase" there, or leverage either.

Then scan along to 1930, and we find 2,604 county agents employed, or 110 on the index. Look at 1932, after a dismal year or two, and the index falls to 103. Then see the chart for 1934, in the midst of the adjustment and farm credit sign-up, and the ratio has leaped to the all-time record of 130. There were 3,173 county agents, exclusive of cotton adjustment assistants, drought helpers, negro leaders, and club sponsors employed in 1934. The 3,072 counties of the U. S. A. were well manned for the agricultural push. The outfit had reached parity in more ways than one.

Meanwhile, all the education has not been on the farm side, for extension folks have been learning plenty themselves in the past five years. They have found that science needs economics to render more perfect aid to agriculture, just as some seeds need inoculation. They have learned that education is futile without sane organization, even as the best tractor in the township won't run without fuel. They have taken a vivid part in the more colorful and effective piece of internal civil rebellion against old inhibitions that farm folks have staged since the westward caravans penetrated the frontier.

Moreover, in the realm of the spirit and the mind, there is a constant effort to broaden the outlook of farm

folks, to have them appreciate that state lines are purely geographic and legal, but never economic lines of demarcation. Countymen are groping for ways to substitute international viewpoints for nationalistic narrowness in this "diminishing" world. There are voices trying to make it clearer to cotton planters or dairymen, or any other class of tillers, that they cannot prosper through being insulated from the common hazards of all.

Our mistake of the past was to uphold agriculture in fine speeches and then break up into clans and small pressure groups in behalf of regions or commodities. The new plan aims to make land operation and rural life the real bond of national union regardless of the crop we raise or the state in which we pay taxes. So far, with a few exceptions, this plan has worked amazingly. It has shattered the old wheeze of scoffers: "farmers are always kicking but never sticking."

If county agents are able to ward off the cankering effects of too much partisan politics in connection with the present economic voting and vowing by an aroused countryside, and if the food consumers' pay envelopes meanwhile begin to fatten a trifle, I am not so much concerned over the future of farming and extension work. With those hurdles safely passed, nothing is going to stop us from eventual victory over ourselves and our basic weakness.

For there is no technicality known which outweighs the prime necessity of mankind; the belly is the boss, and a farm-made national policy for agriculture is right there in the cards, no matter who deals them.

Muck-grown Potatoes

(*From page* 20)

have been tried at the muck experiment farm. The greatest benefit has been from the overhead irrigation. Sub-irrigation was designed to maintain a uniform water table, but leakage into an adjacent drainage ditch spoiled the results to some extent. This year on the plot where a 20-inch water table was maintained, the sub-irrigation equaled the results obtained from overhead.

More care must be exercised in digging potatoes on muck than on upland soils. If at all possible, potatoes should be dug mature. A continuous web on the diggers should be used to prevent the potatoes from being dropped on the shaker. If the elliptical agitators are replaced with rollers, this will prevent shaking and if the speed of the elevator apron is slowed down, the muck will not fall through the chain so readily. The shaker attachment can be covered with rubber hose and the sides with canvas. The ends of the rods or hooks on the elevator chain can be covered with a light steel plate or old rubber tubing bolted through the frame above the apron. Picking baskets should be lined and care should be exercised in handling the freshly dug potatoes. They should not be thrown, dropped, or walked upon.

If immature potatoes are run through a brusher, they will skin and feather badly. If the potato vines are frosted, about two weeks will be required for the skins to set so they will not be badly damaged when run through the brusher.

Potatoes of high quality can be produced on a well-drained muck if a fertilizer high in potash is used. The crop can be made profitable by using short season varieties which are carefully handled and cleaned.

The GOAL

THE LODESTAR of the horizon has ever attracted the pioneering instinct of the American farmer. Once it spurred his covered wagon into the setting sun. Today it lures him to the laboratory where science is helping him to find fertile frontiers within his own fields.

The scientist blazes the trail toward better things. The commercial man widens it into a highway. Both have great responsibility. The benefit of the farmer must always be their watchword and their aim. The common goal is the enrichment of life.

N. V. POTASH EXPORT MY., Inc., 19 West 44th St., New York

"ATICS"

The dusky highwayman stepped out in front of the elderly colored brother.

"Tho up you han's, boy," he ordered.

"Ah cain't; Ah gots rhumatics," replied the other.

"You kin—Ah gots automatics."

"You win, Mistah, you win," he said as his hands went up, "looks lak you' 'atics' is de stronges'."

"What shall I do?" wailed the sweet young thing. "I'm engaged to a man who just cannot bear children."

"Well," remarked the kindly old lady, "you mustn't expect too much of a husband!"

Intoxicated Passenger: "Let me off at the next stop, conductor. I thought this was a lunch wagon."

PRECOCIOUS

During dinner one day a father spoke to his son: "Sonny," he said, "I want to talk to you after dinner. I want to discuss with you the facts of life." So after dinner the son quietly closed the door and said, "Well, Dad, what is it you would like to know?"

When a married man wants sympathy he never goes to a bachelor for it.

An old-timer is one who can remember when about all the abbreviations he had to know were BVD and RFD.

MAYBE!

Mother: "You acted wrongly in disobeying me. I am punishing you to impress it on your mind."

Sonny: "Aren't you proceeding under a slight misapprehension as to the location of the mind."

"Do I really need brushing off?" asked the passenger in the Pullman.

"Does you!" exclaimed the porter with great emphasis, "Boss, I'se broke."

Lawyer: "You want to divorce this woman? Can you name any correspondent?"

King Solomon: "Not offhand, of course, but I strongly suspect the 97th Regiment of the Royal Light Infantry."

AS GOOD AS ANY

Billy's mother looked at him accusingly.

"What have you done with all your money, son?" she asked. "Your little bank is empty."

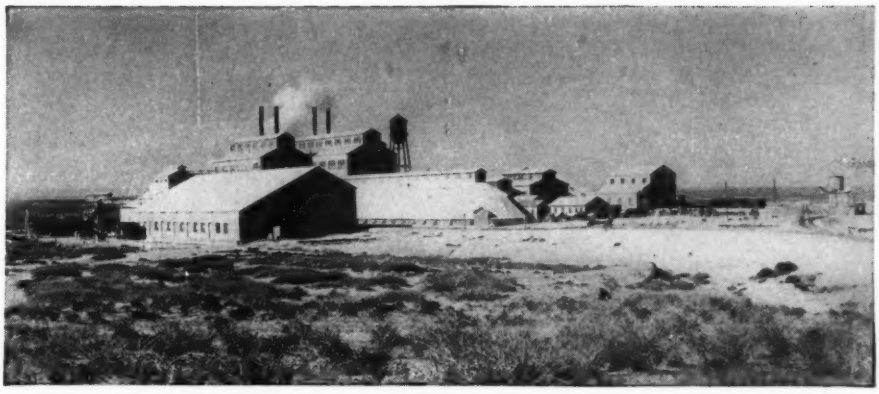
"Well, mother," answered the boy, "yesterday was a rainy day, so I spent it."

"Whenever I look at that girl I think of a hymn."

"Which one?"

"How Firm a Foundation."

Country Bridegroom (on being asked, "Wilt thou have this woman . . . . ?"): "Why, o' course! I come a-purpose!"



The refinery and warehouse of UNITED STATES POTASH COMPANY *near Carlsbad, New Mexico.*

SUNSHINE STATE POTASH
A PRODUCT OF NEW MEXICO U.S.A.

REG. U. S. PAT. OFF.

MURIATE OF POTASH

50% and 62½% K_2O

MANURE SALTS

Approx. 30% K_2O

UNITED STATES POTASH COMPANY, INC.
342 Madison Avenue, New York, N. Y.
Mine and refinery located at Carlsbad, New Mexico

Refinery of U. S. POTASH CO. *near Carlsbad, N. M., with tramroad leading to mine.*

Underground vein showing electric locomotive hauling ore to hoist.

Greetings!

THIS issue of Better Crops—its first under the auspices of the American Potash Institute—heralds an historic event.

It marks the beginning of united effort on the part of the importers and domestic producers of potash to cooperate in the development of the American agricultural and fertilizer industries through the education of the farmer in a more extensive use of plant foods with potash.

As the youngest member of the potash industry, we wish for the Institute a full measure of success—and pledge our hearty cooperation toward this end.

POTASH COMPANY OF AMERICA
Mercantile Trust Building
BALTIMORE, MD.

Printed in U. S. A